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Soil Survey

Pontotoc County Oklahoma

By
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United States Department of Agriculture
and
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Oklahoma Agricultural Experiment Station

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
In cooperation with the
Oklahoma Agricultural Experiment Station

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SOIL SURVEY OF PONTOTOC COUNTY, OKLAHOMA

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United States Department of Agriculture, Bureau of Plant Industry, in cooperation with the Oklahoma Agricultural Experiment Station

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COUNTY SURVEYED

Pontotoc County is in south-central Oklahoma (fig. 1). Ada, the county seat, is approximately 65 miles southeast of Oklahoma City. The county includes an area of 717 square miles, or 458,880 acres, and lies within the great physiographic province of central United States known as the Central Lowland, and in the Cross Timbers section of Oklahoma. The county consists of rolling to gently rolling prairies, forested land, and some hilly land and is divided into two plains by an escarpment that faces north and east. This escarpment

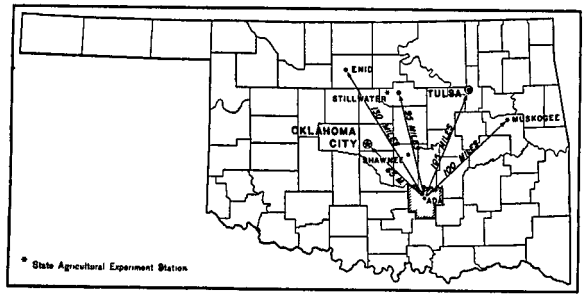

FIGURE 1.—Sketch map showing location of Pontotoc County, Okla.

[1] The field work for this survey was done while the Division was a part of the Bureau of Chemistry and Soils.

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enters the county near its southeastern corner and continues northwestward as a distinct strip of hilly or broken land to a point 3 miles northwest of Lawrence.

The higher plain lying south of the escarpment is a rolling grassland containing a few small forested areas. This plain is characterized by comparatively smooth relief, but much of the land is very stony. In general, the smooth hilltops are stony and the broadly V-shaped shallow valleys are covered by a somewhat thicker layer of soil. This plain lies at an elevation of approximately 1,100 to 1,300 feet above sea level and is well drained by an incompletely developed dendritic type of drainage, which is characteristic of areas drained by tributaries of the Blue River. The plain slopes gently to the southeast. Roff is situated on this plain. The eastern part of the plain is underlain by dolomitic limestone, and the western part by sandstone. The areas underlain by sandstone are much less stony than those underlain by dolomitic limestone.

The plain north of the escarpment is in general more strongly rolling and more deeply dissected than the one south of the escarpment. The valleys are deeper and narrower than those of the southern plain and in many places have angular slopes as a result of outcropping of solid sandstone. This northern plain lies at an elevation ranging from 800 to 1,100 feet above sea level. The northern part is drained mostly by tributaries of the Canadian River. In this section the drainage flows northward and eastward. In the southeastern part of this plain the drainage is into Muddy Boggy and Clear Boggy Creeks, which flow eastward and southeastward. Sandstone is the dominant rock on this plain, but shale, granitic conglomerate, limestone, and old river deposits of sandy clay also are present. The greater part of this plain was covered by forests at the time of settlement by white man, although it included large areas of grassland.

The section of the county described as an escarpment consists of rough, broken, and stony limestone hills in a belt ranging from 2 to 4 miles in width. This land is thoroughly dissected, well drained and unsuited to the production of cultivated crops. The escarpment has a drop of 250 feet in a distance of 2 to 4 miles.

The elevations of the principal towns in the county are as follows: Ada, 1,001 feet above sea level; Roff, 1,250 feet; and Allen, 800 feet.

The native vegetation embraces three distinct types of plant associations. The prairie type of vegetation occurs on the areas of heavier and more calcareous soils, as a rule. This association is dominated by prairie beardgrass (little bluestem). Subdominants are blue-joint turkeyfoot (tall bluestem), silver beardgrass, side-oats grama, blue grama, and buffalo grass. A great many annual and perennial flowering plants also grow on the prairies. Some of the more important of these are milkweed, wild-indigo, poppy-mallow, spring-beauty, dayflower, niggerhead, (purple coneflower), gaillardia, scarlet gaura, hymenopappus, sensitive-rose, evening-primrose, pricklypear, yellow woodsorrel, golden parosela, large-flowered beardtongue, plantain, psoralea, azure or blue sage, blue-eyed-grass, goldenrod, stenosiphon, red false-mallow, bracted spiderwort, puncturevine, verbena, and pokeweed.

The vegetation on coarser textured soils of the uplands is dominated by post oak and blackjack oak. Associated with these trees

are hickory, black oak, persimmon, blackhaw, downy hawthorn (red haw), hackberry, winged elm, ash, redbud, dogwood, and bitternut. The undergrowth consists of coralberry (Indian currant), sumac, bluestem, and sedge. Some of the flowering plants that grow on the prairies are also present in the forest.

Along the stream bottoms the native vegetation consists of a heavy growth of trees, mainly black oak, elm, pecan, chinquapin oak (chestnut oak), American planetree (sycamore), bitternut, walnut, flowering dogwood, and buttonbush. Many of the grasses, trees, and shrubs that grow on the upland are also present on the bottoms. A large part of the native timber in the bottoms has been cut, and the land has been cleared. A few pecan trees remain in places. Johnson grass is a great pest on the bottom-land soils.

The type of plants growing on the upland appears to be influenced to considerable extent by the content of bases in the parent rock of the soil. Prairie types of vegetation grow only on those upland areas where the parent rock is high in content of carbonate of lime, such as limestone, dolomitic limestone, calcareous sandstone, calcareous conglomerate, and heavier shales. Forests are generally present on soils whose parent materials are low in lime, as are sandstone, lighter textured shales, conglomerates, and sandy clays. They also grow on soils of alluvial materials.

The larger timber has been cut, and most of the trees are comparatively small and suited only for the production of firewood and posts. The prairies provide excellent grazing, and on smoother areas they produce considerable native hay.

The scientific and common names of plants mentioned in this report are as follows:

Scientific name	*Common name*
Acerates sp.	Green milkweed.
Andropogon scoparius	Prairie beardgrass, or little bluestem.
Andropogon furcatus	Bluejoint turkeyfoot, or tall bluestem.
Andropogon saccharoides	Silver beardgrass.
Andropogon sp.	Sedge grass.
Asclepias sp.	Milkweed.
Asclepidora viridis	Oblong-leaved milkweed.
Baptisa leucophaea	Large-bracted wild-indigo.
Baptisa vespertina	Blue wild-indigo.
Bouteloua curtipendula	Side-oats grama.
Bouteloua gracilis	Blue grama.
Buchloë dactyloides	Buffalo grass.
Callirhoe alcaeoides	Light poppy-mallow.
Callirhoe digitata	Poppy-mallow.
Callirhoe involucrata	Low poppy-mallow.
Carya (*Hicoria*) *cordiformis*	Bitternut.
Carya (*Hicoria*) *pecan*	Pecan.
Carya (*Hicoria*) sp.	Hickory.
Celtis occidentalis	Hackberry.
Cercis canadensis	American redbud.
Claytonia virginica	Virginia springbeauty.
Commelina virginica	Dayflower.
Cornus asperifolia	Roughleaf dogwood.
Cornus florida	Flowering dogwood.
Crataegus mollis	Downy hawthorn, or red haw.
Diospyros virginiana	Common persimmon.
Echinaea angustifolia	Niggerhead, or purple coneflower.
Fraxinus sp.	Ash.
Gaura coccinea	Scarlet gaura.
Hymenopappus corymbosus	Hymenopappus.
Juglans sp.	Walnut.

Scientific name	*Common name*
Leptoglottis nuttalli (Schrankia uncinata)	Sensitive-rose.
Oenothera sp.	Evening-primrose.
Opuntia sp.	Pricklypear.
Oxalis corniculata	Yellow woodsorrel.
Parosela aurea	Golden parosela.
Penstemon albidus	Lare-flowered beardtongue.
Phytolacca americana	Common pokeweed.
Plantago sp.	Plantain.
Plantanus occidentalis	American planetree, or sycamore.
Psoralea floribunda	Scurfpea, or psoralea.
Psoralea tenuiflora	Slender scurfpea.
Quercus marilandica	Blackjack oak.
Quercus muhlenbergi	Chinquapin oak, or chestnut oak.
Quercus stellata	Post oak.
Quercus velutina	Black oak.
Salvia azurea	Azure sage, or blue sage.
Sisyrinchium campestre	Blue-eyed-grass.
Solidago sp.	Goldenrod.
Sphaeralcea coccinea	Red false-mallow.
Stenosiphon linifolius	Stenosiphon.
Tradescantia bracteata	Bracted spiderwort.
Tribulus terrestris	Punctureviné.
Ulmus alata	Winged elm.
Verbena bipinnatifida	Dakota verbena.
Verbena canadensis	Rose verbena.
Viburnum prunifolium	Blackhaw.

The area that is now Pontotoc County was a part of the Louisiana Purchase and was settled by Indians of the Washita tribe at the time it was acquired by the United States. This land was ceded to the Chickasaw Nation in return for the land they held in Mississippi and Alabama. The Chickasaw Indians moved from their eastern holdings to this area during the period 1835–47. They settled first along the stream valleys, particularly along Muddy Boggy Creek and the Blue River. They were an agricultural people who cleared some of the land in this section and established a peaceful nation. They had a modern form of constitutional government with a governor and a legislature. The capital was located at Tishomingo, approximately 35 miles south of Ada. Some time after the land was settled by the Chickasaws, it was divided into units of 160 acres, and the Indians were privileged to obtain an allotment of 160 acres by fencing their land and living on it. At the time of statehood it became lawful for Indians to sell or lease their allotments to white men, who rapidly settled the area.

Pontotoc County was organized in 1907 from parts of the land formerly belonging to the Chickasaw and Choctaw Nations. The population of the county in 1930 was 32,496, 65.3 percent of which was classed as rural.

Ada, the county seat and largest city, has a population of approximately 16,000. This city has grown rapidly since the 1930 census was taken, when 11,261 inhabitants were reported. The populations of smaller towns are as follows: Roff, 772; Allen, 1,438, of whom 49 persons live in Hughes County; and Francis, 607. These towns are surrounded by comparatively large areas of arable land. Fittstown is a town of recent origin, incident to the development of an oil field in its vicinity. Its population is estimated at about 1,200.

Branch lines of the Atchison, Topeka & Santa Fe Railway, the St. Louis-San Francisco Railway, and the Oklahoma City-Ada-Atoka Railway pass through Ada. The Kansas, Oklahoma & Gulf Railway

extends along the eastern border of the county. These branch lines lead to main lines and provide the county with rail facilities for transporting its products to centers of population.

This county is crossed by four State highways, three of which are paved for part of their length and graveled for the rest. These main State highways and the principal county and township roads are generally in good condition for travel. Other roads are generally passable except during long periods of wet weather. Roads follow section lines except in sections of rough land or range land. A large part of the produce is shipped by truck to Oklahoma City over paved roads.

The towns are well supplied with schools, many of which are consolidated, and busses bring children from rural areas to the towns. This makes elementary and secondary education within reach of the children in a large part of the county. One- and two-room rural schoolhouses are in many places where consolidated schools have not been established. East Central State Teachers College in Ada provides higher educational facilities for residents of this section.

The towns are adequately supplied with churches, but in most of the rural sections schoolhouses are utilized as churches on Sunday.

Ada obtains its water supply from a large spring on Byrds Mill Creek. The water is piped to Ada, where it is stored in a reservoir. Well water is available in the sandy parts of the county at a depth ranging from 20 to 100 feet. In other parts water is available in shallow wells in stream bottoms. Small dams are constructed in many places to impound water for livestock.

One of the most important industries is the production of portland cement. Large quarries are at Lawrence, and the quarried limestone and shale are carried by rail to a large cement plant at Ada. A large brick factory in Ada utilizes materials of the Francis geological formation.

Small deposits of asphalt have been mined at various times. Glass sand is mined at Roff, and a glass factory is at Ada. Extensive beds of sand and gravel supply materials that are used to some extent in road building and in making concrete.

The oil and gas industry has made rapid strides since the discovery of the Fitts field south of Ada. Several smaller fields, of which the principal one is the Beebe field northwest of Ada, were developed at an earlier time.

CLIMATE

The climate of Pontotoc County is distinctly continental, with comparatively warm summers and cool winters. The mean annual temperature is 61.8° F. Extremes of 109° in summer and −4° in winter are reported. The mean annual rainfall is 39.97 inches. The driest months of the year are November to March, inclusive. May is generally the wettest month of the year, and February is the driest. July is the driest summer month. Droughts occasionally reduce crop yields, especially of corn, and dry weather in late June and early July often is very detrimental to this crop. Cotton, oats, and sorghums are well suited to the climatic conditions prevailing in this county. Cotton and corn compete for first place in the cropping systems in common use. Cotton is the dominant crop following years of high prices for that staple. Many small fields are

devoted to potatoes and peanuts. Alfalfa is grown on soils where additional moisture is received from run-off or overflow.

The average date of the first killing frost is November 6, and the earliest on record is October 19. The average date of the latest killing frost is March 26, and the latest on record is April 25. The average frost-free period is 225 days. Late frosts in spring sometimes damage fruit crops and early planted cotton and corn.

Field work may be conducted throughout the winter except during occasional "northers" (short severe cold spells), which occur at intervals during the winter. Now and then the ground freezes to a depth of 6 or 8 inches for a short period. Hailstorms often cause injury to crops in small local areas, but injurious windstorms are rare.

Table 1, compiled from the records of the United States Weather Bureau station at Ada, may be considered representative of climatic conditions for the county as a whole.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Ada, Pontotoc County, Okla.*

[Elevation, 1,001 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1908)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	42.3	79	0	2.15	0.07	(1)	1.5
January	39.8	84	−4	2.13	.99	1.85	2.6
February	44.2	90	3	1.56	.83	4.33	1.0
Winter	42.1	90	−4	5.84	1.89	6.18	5.1
March	53.0	96	9	2.64	.82	2.80	1.0
April	61.2	91	24	4.06	4.76	6.83	(1)
May	68.5	95	34	6.36	2.57	13.16	.0
Spring	60.9	96	9	13.06	8.15	22.79	1.0
June	77.3	105	42	4.30	2.34	16.42	.0
July	82.3	106	56	3.08	5.21	1.17	.0
August	81.9	109	50	3.67	5.04	2.05	.0
Summer	80.5	109	42	11.05	12.59	19.64	.0
September	74.9	104	39	4.04	.42	3.07	.0
October	63.3	94	19	3.70	.32	7.58	(1)
November	52.3	86	11	2.28	1.08	6.77	(1)
Fall	63.5	104	11	10.02	1.82	17.42	(1)
Year	61.8	109	−4	39.97	24.45	66.03	6.1

[1] Trace.

AGRICULTURAL HISTORY AND STATISTICS

The first white settlers in Pontotoc County were cattlemen who had large herds of cattle on the open range. After the Chickasaw Indians moved from the more eastern States, they settled in this section, particularly along the bottoms of the principal streams. They put small areas in cultivation, in order to supplement the food supply obtained by hunting, fishing, and trapping, and pastured cattle on the range. The allotment plan allowed each Indian to claim 160 acres of land merely by fencing it. After the time of statehood (1907), white people were allowed to buy this land. Early agricultural practices

were primitive, and the cultivated area on each farm was small. Trees generally were killed by girdling and were left standing in the fields. Grassland areas were put into cultivation merely by plowing the sod.

As the white people settled this section, the smoother areas of upland were put into cultivation. Corn was the principal crop in 1909, at the time the first agricultural census was made. Cotton and prairie hay were less important crops. In 1919, a year following comparatively high prices for cotton, the acreage of this crop was greater than that of any other crop in the county; corn has exceeded cotton in acreage since that time. Oats, grain sorghums, peanuts, alfalfa, and native hay are other important crops. The acreages of the principal crops in 1909, 1919, 1929, and 1934 are given in table 2.

TABLE 2.—*Acreages of principal crops in Pontotoc County, Okla., in stated years*

Crop	1909	1919	1929	1934
	Acres	*Acres*	*Acres*	*Acres*
Corn	53,657	40,606	50,138	37,637
Cotton	30,143	66,388	34,358	31,380
Oats:				
Threshed	2,614	15,972	6,855	5,114
Cut and fed unthreshed			4,462	3,578
Wheat	202	8,246	287	432
Grain sorghums	18	266	1,769	5,076
Sorghums for silage, hay, and fodder		[1] 7,202	6,202	8,258
Peanuts	14	877	5,133	2,080
Potatoes	601	357	684	955
All hay	5,047	11,843	[2] 8,878	[3] 15,752
Alfalfa	202	3,271	1,659	2,661
Legumes for hay		700	1,666	1,769
Other tame hay	742	3,384	2,001	[3] 11,322
Wild hay	4,103	4,488	3,552	
Sweetclover pasture			2,054	
	Trees	*Trees*	*Trees*	*Trees*
Peaches [4]	41,201	41,059	19,687	12,091
Nuts, mostly pecans [4]	7,227	9,740	22,152	
	Vines	*Vines*	*Vines*	*Vines*
Grapes [4]	4,480	9,289	12,979	11,554

[1] For forage only.
[2] Excludes sorghums for hay.
[3] Includes wild hay.
[4] Peach trees, nut trees, and grapevines are reported for the years 1930 and 1935, respectively.

The total value of all farm crops was $1,840,404 in 1929; butter, cream, and whole milk sold, $269,930; poultry raised, $195,939; and chicken eggs produced, $228,165. Domestic animals, chickens, and bees were valued at $1,583,100.

The livestock census for 1910, 1920, 1930, and 1935 is given in table 3.

TABLE 3.—*Number of livestock on farms and ranges in Pontotoc County, Okla., in stated years*

Livestock	1910	1920	1930	1935
Horses	6,576	6,763	4,626	4,216
Mules	3,361	5,745	4,763	4,073
Cattle	27,681	22,448	23,978	33,647
Sheep	107	529	1,066	2,741
Goats	270	411	385	618
Swine	19,171	18,843	15,598	14,778
Chickens	[1] 107,613	132,396	131,969	120,221
Bees, hives	417	925	1,480	[2]

[1] All poultry.
[2] Not reported.

Fertilizers are used to a very limited extent, and their use is restricted to the sandy soils. Nitrate and phosphate fertilizers are the

most common types in use. Only 22 farms, or 0.8 percent of all farms, reported the purchase of fertilizer in 1929, at a cost of $1,116, or an average expense of $50.73 a farm reporting.

Most of the labor is provided by the farmer and his family, but some itinerant labor is used in cotton chopping and picking. The hire of labor was reported by 813 farms, or 30.4 percent of all farms, in 1929, at a total expense of $97,475, or an average of $119.90 a farm reporting.

The expenditure for feed exceeded that for labor. The purchase of feed was reported by 839 farms, or 31.4 percent of all farms, at a total cost of $135,437, or an average of $161.43 a farm reporting.

In 1935, 368,897 acres, or 79.2 percent of the area of the county, were included in 3,038 farms. Of the land in farms, 172,547 acres, or 48.8 percent, were available for crops. Most of the land not used for crops is in pasture. The average size of farms was 121.4 acres in 1935, which represented an increase from the average size of 88.6 acres in 1910. The more common sizes of farms are 80 and 160 acres. The tendency toward increased size of farms has been encouraged by the introduction of power machinery, which makes it possible for a farmer to handle a larger acreage to advantage.

Tenancy has decreased from 78.5 percent in 1910 to 66.9 percent in 1935. This decrease probably has been a result of greater ownership of land by white people. Most of the rentals are on a share basis. The landlord's share of the crop is one-fourth of the cotton and one-third of the other crops. If the landlord furnishes machinery, teams, and seed, he receives one-half of the crop. Cash rent is paid only for pasture land.

SOIL-SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil, as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil [2] and its content of lime and salts are determined by simple tests.[3] Drainage, both internal and external, and other external features, such as relief, or lay of the land, are taken into consideration, and the interrelation of soils and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics soils are grouped into mapping units. The three principal ones are (1) series, (2) type, and (3) phase. Areas of land, such as coastal beach or

[2] The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values indicate alkalinity, and lower values indicate acidity.

[3] The total content of readily soluble salts is determined by the use of the electrolytic bridge. Phenolphthalein solution is used to detect a strong alkaline reaction.

bare rocky mountainsides, that have no true soil, are called (4) miscellaneous land types.

The most important group is the series, which includes soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics and the same natural drainage conditions and range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The soil series are given names of places or geographic features near which they were first found. Thus, Durant, Denton, Verdigris, and Osage are names of important soil series in this county.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Verdigris fine sandy loam and Verdigris clay loam are soil types within the Verdigris series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the soil unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type, which differs from the type in some minor soil characteristics that may have practical significance. Differences in relief, stoniness, and the degree of accelerated erosion frequently are shown as phases. For example, within the normal range of relief for a soil type, there may be areas that are adapted to the use of machinery and the growth of cultivated crops and others that are not. Even though there may be no important differences in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such an instance the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, soils having differences in stoniness may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, and miscellaneous land types in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape.

SOILS AND CROPS

The soils of Pontotoc County are varied in physical and chemical characteristics and in adaptations to crops, owing to the diversity of topographic and geologic features. The soils are of both dark-colored and light-colored types. The dark-colored soils have developed under a vegetation consisting largely of bluestems and other bunchgrasses. These soils are members of the Rendzina, Reddish Prairie, and Prairie great soil groups. They have a comparatively high content of organic matter in the surface soils, which are friable,

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somewhat granular, and easy to cultivate. Most of these soils are of medium and fine textures and are well drained. These conditions are favorable to the growth of oats, cotton, grain sorghums, and other crops. The light-colored soils have developed under forest vegetation, largely of post oak and blackjack oak, and they belong to the group of Red and Yellow Podzolic soils. These soils have grayish-brown sandy surface soils and yellow and yellowish-red subsoils. The change in color and texture between the surface soil and the subsoil of these soils is distinct, the reaction is acid, and the contents of organic matter and available plant nutrients are comparatively low. Such soils are best suited to the production of cotton, peanuts, watermelons, cowpeas, and fruits. Considerable areas of soils developed from alluvial materials occupy the flood plains of several valleys. Most of these soils, especially those of medium texture, are highly productive and suited to growing corn, cotton, alfalfa, pecans, and Johnson-grass hay. Large areas are steeply rolling and have thin light-colored surface soils. These soils are better suited to pasture and hay crops than to cultivated crops, as they return low yields when cultivated. Areas of decidedly nonarable lands in several parts of the county are used for pasture and forestry.

Figure 2 presents a generalized soil map of the county, showing the soils as follows: (1) Soils of the bottom lands, mainly Yahola very fine sandy loam, Yahola fine sand, Teller very fine sandy loam, and Stidham fine sand; (2) medium-textured dark-colored soils of the uplands and terraces developed under grass, including Durant very fine sandy loam, Durant fine sandy loam, and Durant very fine sandy loam, eroded phase; (3) Vernon clay; (4) dark-colored heavy-textured soils of the uplands developed under grass, including Summit clay loam and Parsons very fine sandy loam; (5) rough stony land (Hector soil material); (6) rough stony land (Denton soil material); (7) sandy light-colored soils developed from old alluvium, including Dougherty fine sandy loam, Dougherty fine sandy loam, shallow phase, Stidham fine sandy loam, and Stidham fine sandy loam, rolling phase; (8) reddish-brown soils of the uplands developed under grass from dolomitic limestone, including Newtonia silt loam and Crawford stony loam; (9) gravelly soils developed from granitic conglomerate, including Chigley fine sandy loam and Chigley gravelly loam; (10) Denton clay loam, deep phase; (11) Hanceville fine sandy loam; and (12) Roff gravelly loam.

Drainage problems are unimportant in Pontotoc County except on the alluvial soils, which are overflowed. In many places, straightening the channels of the creeks is successful in reducing the extent and frequency of overflows. This has been done on a few farms, and in most places no other drainage operation is necessary.

A few truck farmers resort to irrigation from wells, in order to keep their crops growing during the drier part of the summer. Tomatoes, peppers, and sweet corn are the principal crops grown in this manner. Field crops cannot, as a rule, be produced at a profit under irrigation supplied by pumps. Spring water is used for irrigation in a few places.

The agriculture is fairly well diversified, with cotton and corn as the dominant crops. Other important crops are oats, sorghums, peanuts, alfalfa, and pecans. Cotton is the cash crop and is grown on nearly every farm. A large proportion of the farms include some

areas of land unsuited to the production of cultivated crops, and most farmers raise livestock to utilize such areas. Some feed crops, such as sorghums or corn, are also grown.

The soils of this county have been placed in five groups on the basis of their chief observable characteristics and their relative values for crop production as follows: (1) Dark-colored soils of the uplands and

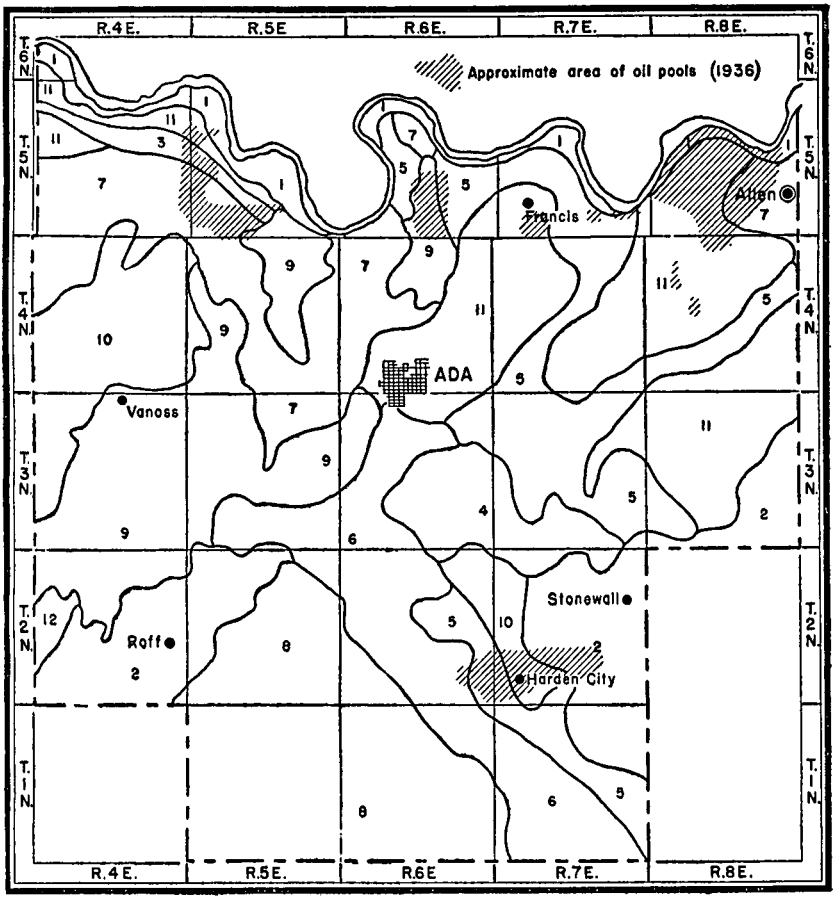

FIGURE 2.—Generalized soil map of Pontotoc County, Okla., showing: 1, Soils of the bottom lands; 2, medium-textured dark-colored soils of the uplands and terraces; 3, Vernon clay; 4, dark-colored heavy-textured soils of the uplands; 5, rough stony land (Hector soil material); 6, rough stony land (Denton soil material); 7, sandy light-colored soils developed from old alluvium; 8, reddish-brown soils of the uplands developed from dolomitic limestone; 9, gravelly soils developed from granitic conglomerate; 10 Denton clay loam, deep phase; 11, Hanceville fine sandy loam; and 12, Roff gravelly loam.

terraces, (2) light-colored soils of the uplands and terraces, (3) soils of the bottom lands, (4) shallow soils of the uplands, and (5) nonarable soils and land types.

In the following pages the soils of Pontotoc County are described in detail, and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map, and their acreage and proportionate extent are given in table 4.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in Pontotoc County, Okla.*

Soil type	Acres	Per-cent	Soil type	Acres	Per-cent
Durant very fine sandy loam	32,448	7.1	Yahola very fine sandy loam	3,392	0.7
Durant fine sandy loam	9,152	2.0	Yahola fine sand	1,216	.3
Summit clay loam	8,384	2.0	Teller very fine sandy loam	1,152	.3
Denton clay loam, deep phase	21,824	4.7	Chigley gravelly loam	20,544	4.5
Newtonia silt loam	25,792	5.6	Dougherty fine sandy loam, shallow phase	20,928	4.6
Parsons very fine sandy loam	12,864	2.8	Durant very fine sandy loam, eroded phase	23,232	5.1
Brewer very fine sandy loam	512	.2	Denton clay loam	3,840	.8
Vanoss fine sandy loam	1,984	.4	Vernon clay	7,168	1.6
Fitzhugh fine sandy loam	896	.2	Roff gravelly loam, shallow phase	768	.2
Roff gravelly loam	3,904	.8	Crawford stony loam	22,912	5.0
Hanceville fine sandy loam	46,528	10.1	Denton stony clay loam	5,760	1.2
Cleburne fine sandy loam	7,296	1.6	Rough stony land (Denton soil material)	28,096	6.1
Stidham fine sandy loam	9,792	2.1	Rough stony land (Hector soil material)	46,592	10.1
Stidham fine sandy loam, rolling phase	6,336	1.4	Tallihina very fine sandy loam	704	.2
Stidham fine sand	4,160	.9	Riverwash	448	.1
Dougherty fine sandy loam	2,048	.4	Quarries	128	(1)
Buckhorn fine sandy loam	2,368	.5	Total	458,880	
Chigley fine sandy loam	13,504	2.9			
Verdigris clay loam	32,064	7.0			
Verdigris fine sandy loam	6,144	1.3			
Osage clay loam	24,000	5.2			

[1] Less than 0.1 percent.

DARK-COLORED SOILS OF THE UPLANDS AND TERRACES

The dark-colored soils are the more productive soils of the uplands and terraces and have developed under prairie grasses. These soils have a moderately high content of organic matter and are not leached to a great extent. The reaction of the surface soil is, in most places, neutral. These are excellent soils for farming when first put into cultivation, and their productivity can be maintained if reasonable precautions are taken to prevent sheet and gully erosion.

The soils of this group have dark or moderately dark surface soils, which are somewhat granular and friable. The color of the soil gradually becomes lighter, the texture generally finer, and the consistence heavier with depth. As the soils contain considerable quantities of nitrogen and other essential plant nutrients, they are better suited to the production of corn, oats, and sorghum than are the light-colored soils developed under a forest vegetation. The native vegetation on these dark-colored soils is dominantly bluestems, with some side-oats grama, blue grama, and buffalo grass. Fair crops of native hay are produced during most seasons.

The soils included in this group are Durant very fine sandy loam; Durant fine sandy loam; Summit clay loam; Denton clay loam, deep phase; Newtonia silt loam; Parsons very fine sandy loam; Brewer very fine sandy loam; Vanoss fine sandy loam; Fitzhugh fine sandy loam; and Roff gravelly loam.

Durant very fine sandy loam.—Durant very fine sandy loam is a dark-brown prairie soil developed from calcareous sandstone and shale. The surface soil, to a depth of about 9 inches, is dark-brown or nearly black rather friable very fine sandy loam with a faintly granular structure. Its organic-matter content is high, and its reaction is neutral. It grades into dark-brown loam, which in dry exposed cuts separates into large prisms, 6 or 8 inches in diameter. These prisms break horizontally or obliquely into plates ranging from 2 to 5 inches in thickness, which, in turn, break into small

irregular soft clods. This material also is neutral in reaction. At a depth of approximately 18 inches it grades into brown or dark-brown variegated friable clay loam or clay, which has a few reddish-brown specks and is likewise neutral in reaction. Below a depth of 30 inches is mottled brown, yellowish-brown, and rust-brown clay loam or clay, containing a few rounded iron pellets. The reaction of this material is neutral. Between depths of about 36 and 54 inches is gray, yellow, and rust-brown clay loam or clay with numerous black iron concretions and a few calcium carbonate accretions. Below this is yellow and gray mottled clay loam or clay containing fragments of weathered sandstone, which may or may not be calcareous. In some places the soil is developed from calcareous shales.

Comparatively large areas of Durant very fine sandy loam are in the vicinities of Roff, Fitzhugh, Stonewall, Jesse, Union Valley School, Lula, and Conway School. It covers a larger area than any other soil of this group. It is associated with Durant fine sandy loam in the vicinities of Roff and Fitzhugh.

The relief is undulating to gently rolling. In some parts of the county the soil occurs in the broad shallow valleys, and in such places the ridge tops are covered with Durant fine sandy loam. The soil is adequately drained. The native vegetation consists largely of bluestems, with some side-oats grama, blue grama, buffalo, and silver beardgrass.

This is one of the valuable agricultural soils in the county, and where it has received moderately good care it is productive. Owing to its high organic-matter content, it is fairly satisfactory for the production of corn, which yields about 18 bushels to the acre. Cotton yields about 130 pounds of lint, sorghums 2½ tons of forage, and oats about 35 bushels to the acre. About 25 percent of the soil is devoted to cotton, 14 percent to corn, 14 percent to oats, 11 percent to sorghums, and 36 percent to native hay and pasture.

This soil is subject to erosion. In places satisfactory protection against erosion is afforded by terracing, strip cropping, and contour tillage. Large areas are now classed as Durant very fine sandy loam, eroded phase, because they have become so eroded that they are no longer well suited to the production of cultivated crops. This soil does not respond so well to additions of fertilizers as do the light-colored forested soils.

Durant fine sandy loam.—Durant fine sandy loam is a sandy Prairie soil developed from calcareous or noncalcareous sandstone. The topmost soil layer, about 8 inches thick, is dark-brown or brown fine sandy loam. In dry exposed cuts the material cracks into large irregular blocks, from 8 to 12 inches in diameter which can be easily broken into soft clods. This material contains considerable organic matter. The reaction is neutral to slightly alkaline throughout. The surface soil grades into slightly darker brown rather friable heavy fine sandy loam with a comparatively high organic-matter content, but this material becomes somewhat lighter colored with depth. Below a depth of about 15 inches it gives way gradually to brown variegated fine sandy loam or yellow crumbly clay. At a depth ranging from 20 to 30 inches, this material, in turn, grades into brown and yellow mottled fine sandy loam or sandy clay, containing a few red or rust-brown spots that appear to be concretions of iron oxide. Be-

low a depth of 30 inches is mottled gray, yellow, and red fine sandy loam or fine sandy clay. The gray color becomes more prominent until a depth of about 48 inches is reached, where the material changes to gray loamy fine sand that is very low in organic-matter content. This sand rests on consolidated sandstone at a depth of about 60 inches. Some roots penetrate to bedrock.

Small areas of this soil in the vicinity of Roff, especially those adjacent to Fitzhugh fine sandy loam, have a reddish-brown hue in the subsoil.

The principal areas of this soil are within a radius of 3 miles of Roff. An important area is 1 mile northeast of Union Valley School. The soil occupies gently rolling divides.

The native vegetation is largely bluestems, with some side-oats grama, silver beardgrass, and blue grama.

The soil is moderately productive, but it has such slight consistence that the native fertility is easily depleted by the customary types of farming. Depletion of the native fertility can be minimized by the use of cropping systems that help to maintain the supply of organic matter. Cotton yields an average of about 120 pounds, corn 15 bushels, oats 30 bushels, and sorghums about 2 tons of forage to the acre. Approximately 20 percent of the soil is cropped to cotton, 30 percent to corn, 15 percent to oats, 5 percent to sorghums, and 5 percent to peanuts, and 25 percent is devoted to hay and pasture.

Erosion is much less severe on this soil than on Durant very fine sandy loam because rain water is absorbed more readily, owing to the slighter consistence as compared with the very fine sandy loam. Strip cropping and contour tillage, however, are recommended.

Summit clay loam.—Summit clay loam is a deep black Prairie soil developed from limestone and interbedded limestone and calcareous shale. The surface soil consists of black or dark-brown crumbly granular clay loam, from 8 to 12 inches thick, which has a neutral reaction and a high organic-matter content. It grades into dark-brown or yellowish-brown coarsely granular rather crumbly clay, which is likewise neutral in reaction. At a depth ranging from about 15 to 20 inches is brown clay, with a slight olive hue, or dark-yellow clay, mottled with dark gray, which grades, at a depth ranging from 26 to 30 inches, into olive-drab or olive-gray clay with no definite structure. This material is highly calcareous and contains a few white chert fragments. The depth of root penetration is about 45 inches. Limestone bedrock lies several feet beneath the surface. In places at the base of slopes, the surface soil receives a slight accumulation of dark soil, and here it is somewhat thicker than elsewhere.

Summit clay loam occurs in areas forming a general belt 8 miles long and 2 or 3 miles wide, extending from Ada to the southeastern corner of the county.

This soil occurs in gently undulating areas, and drainage is free in most places. The native vegetation consists of a heavy growth of prairies grasses, with bluestems and side-oats grama predominating.

Summit clay loam is a good soil for the production of corn, which yields about 24 bushels an acre. Cotton returns about 150 pounds of lint, oats 45 bushels, and sorghums 2.8 tons of forage to the acre. About 21 percent of this soil is planted to cotton, 16 percent to corn,

30 percent to oats, and 7 percent to sorghums, and 26 percent is in hay and pasture.

As the granular surface soil erodes rapidly under cultivation, the soil requires protection to prevent erosion.

Denton clay loam, deep phase.—Denton clay loam, deep phase, is a dark heavy-textured Rendzina soil developed from limestone and calcareous shales. The topmost 4 to 8 inches of this soil is dark-brown finely granular clay loam, which, in places, contains a few small chert fragments. In places the soil is calcareous, but, as a rule, it does not respond to tests for calcium carbonate. Below a depth of 10 or 12 inches is dark-brown clay that breaks into irregular clods on drying. It is calcareous in places and contains less organic matter than the surface soil. It grades into yellowish-brown or brown non-calcareous clay or, in places, into mottled gray and yellow chalky clay containing numerous chert and limestone fragments. Where the color is dominantly gray, the material is highly calcareous and rather friable. This layer rests on limestone or limestone and interbedded calcareous shale at a depth of about 6 feet. Plant roots are noted at a depth of about 42 inches.

The principal areas of this soil occur in a discontinuous belt about 3 miles wide extending north and south of Fittstown. Another such belt extends westward from Gaar Corner and Vanoss to the county line. A smaller area is around Haskell School. The soil covers a fairly large total area.

The soil occurs in rolling areas and is well drained in both surface soil and subsoil. The native vegetation consists largely of bluestems and other prairie grasses. Post oak trees have encroached on small areas in the vicinities of Fittstown and Vanoss.

This soil is comparatively fertile. Organic matter is abundant in the upper layers. The soil is particularly suited to the production of oats and corn, but droughts often damage the corn. Acre yields of corn are said to average about 20 bushels. Cotton yields about 140 pounds of lint, oats 37 bushels, and sorghums 2½ tons of forage. About 22 percent of this soil is cropped to cotton, 16 percent to oats, 16 percent to corn, and 10 percent to sorghums, and 37 percent is in hay and pasture.

Erosion is severe on this soil after the native grass is removed. Strip cropping and contour tillage are reported as very beneficial in the prevention of erosion on some fields. Run-off is rather rapid, as the heavy sloping surface soil does not absorb moisture rapidly.

Newtonia silt loam.—Newtonia silt loam is a Reddish Prairie soil developed from dolomitic limestone. The 8-inch surface soil is brown rather friable silt loam, slightly laminated at the top, and when dry is slightly prismatic below a depth of 2 inches. The material is neutral in reaction. The organic-matter content is moderately high but apparently not so high as in most of the other grassland soils of the county. The surface soil grades into reddish-brown or brown heavy silt loam or silty clay loam, which appears more distinctly red after pressure on the soil particles. This material breaks into large indistinct prisms in dry exposed cuts, is rather friable, and is slightly alkaline in reaction. It grades, at a depth of 18 inches, into red or reddish-brown silty clay loam or crumbly clay, which is friable but not prismatic. The soil rests on solid bedrock of dolomitic lime-

stone at a depth of 3 to 5 feet. In the deeper areas of this soil roots penetrate to a depth of 48 inches.

An area of slightly more than 1 square mile just east of Fitzhugh differs from the typical soil in that it contains much black limestone gravel throughout the surface soil and the subsoil. The gravel does not seem to interfere with cultivation in most places.

The principal areas of the typical soil occur in the drainage basins of Blue and West Blue Creeks east and southeast of Roff. It occupies the stream valleys, as a rule, but in many places it extends over the divides. The relief is gently rolling in most places. The soil covers a rather large total area. It is intimately associated with Crawford stony loam, which is suited only for pasture.

As this soil is comparatively shallow, it erodes rapidly under cultivation if not protected, because of excessive run-off of rain water from higher lying stony areas. This feature is in part responsible for the use of much of this soil as pasture land.

About 5 percent of this soil is cultivated to cotton, 5 percent to sorghums, 5 percent to corn, and 5 percent to oats, and the remaining 80 percent is in native grasses used for both hay and pasture. The grasses are largely bluestems. Average yields are difficult to determine, because most of the soil is included in large cattle ranches. Estimated average acre yields are as follows: Cotton, 90 pounds of lint; corn, 13 bushels; oats, 30 bushels; and sorghums, 1.7 tons of forage.

Parsons very fine sandy loam.—Parsons very fine sandy loam is a claypan soil, or Planosol, developed under prairie vegetation from noncalcareous shales. The 6-inch surface soil is grayish-brown friable very fine sandy loam that breaks into thin laminations or horizontal plates when dry. The moist soil appears nearly black. This layer has a high organic-matter content and a neutral reaction. It grades into grayish-brown strongly acid silt loam or silty clay loam, which is friable or crumbly when moist and appears to contain considerable organic matter. This material on drying in exposed situations separates into large prisms, from 8 to 10 inches in diameter, which in places break horizontally and form thick plates. In places, at a depth of 10 to 14 inches, it grades into a 2-inch layer of light-gray silt loam or clay loam, faintly mottled with yellowish brown, neutral in reaction and fairly friable. The latter material rests on dark-brown, dark-gray, or gray and red mottled tough plastic clay that is neutral in reaction and separates into hard irregular or cubical clods or blocks ranging from 2 to 6 inches in diameter. The clods may be broken into smaller, sharper edged clods with shiny surfaces. This layer grades into olive-brown friable clay containing a few white chert particles and black concretions or pellets. This material is faintly alkaline in reaction. At a depth of about 49 inches is mottled gray and yellowish-brown friable clay, which in reality is only slightly altered shale. The shale is not calcareous and is neutral in reaction. This soil is characterized by numerous slick spots or salty spots in which the surface soil is very shallow and the dense clay comes almost to the surface. These spots do not cover a large total area but give many fields a spotted appearance. Owing to the sparseness of the vegetation on the slick

spots, some sheet erosion has taken place. In cuts the top of the subsoil appears to be wavelike.

This soil occurs in shallow valleys and on flats lying somewhat lower than the adjoining areas, principally in the eastern part of the county in the vicinities of Conway School, Clear Boggy School, Frisco, Stonewall, and Steedman.

The areas occupied by this soil are flat to gently undulating, and surface drainage is adequate. Subsoil drainage is restricted by the heavy claypan subsoil. The native vegetation is prairie grass, with bluestems dominant.

This soil is moderately well supplied with plant nutrients and organic matter. It is said to be particularly suited to the production of oats but is not favorable to the production of corn. Corn does fairly well, however, if the rainfall is adequate, and it returns an average yield of about 17 bushels an acre. Cotton yields about 140 pounds of lint, oats 45 bushels, and sorghums 2.3 tons of forage an acre. About 20 percent of this soil is devoted to cotton, 30 percent to oats, 10 percent to sorghums, and 20 percent to corn, and 20 percent is in hay and pasture.

Brewer very fine sandy loam.—Brewer very fine sandy loam is a dark soil somewhat similar to Parsons very fine sandy loam and intermediate between the Prairie soils and the Planosols. The surface soil, to a depth of about 18 inches, is brown or dark grayish-brown very fine sandy loam, which in dry exposed cuts breaks vertically into large prisms from 5 to 8 inches in diameter. The material contains considerable organic matter and is rather friable under ordinary moisture conditions. Below this is a distinct 3-inch layer of gray material, having the same or heavier texture, a low organic-matter content, and a neutral reaction. It rests on dark-brown or brown tough heavy clay with a few red and rust-brown mottlings in places. The reaction is neutral. This material grades, at a depth of 30 inches, into yellowish-brown clay containing a few black concretions and, here and there, accretions of calcium carbonate. The fine earth is not calcareous. Below a depth of 50 inches and continuing to a depth ranging from 15 to 20 feet is yellowish-brown and gray mottled clay loam that contains a few rust-brown spots and appears to be old river sediments. It is part of the Gerty sand formation.

A few small gray slick spots occur in areas of this soil, in which the dense clay lies near the surface and a white incrustation indicates a salt content.

Brewer very fine sandy loam occupies a few small flat or gently undulating bodies north and west of Summers Chapel School and at Allen, aggregating a very small total area. Erosion is not active, except where deep and narrow gullies cut back into flatter areas from the slopes. Surface drainage is adequate, but subsoil drainage is restricted.

The native vegetation consists of prairie grasses, predominantly bluestems. The soil is comparatively fertile, but it covers so small an area that reliable figures on crop yields are difficult to obtain. It is estimated that cotton yields 130 pounds of lint, oats 32 bushels, sorghums 2 tons of forage, and corn 15 bushels an acre. About 20 percent of this soil is cropped to cotton, 10 percent to oats, 10 percent to sorghums, 40 percent to corn, and 10 percent is in native pasture.

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This soil does not respond so well to fertilization as do the light-colored soils of the uplands and terraces, although additions of manure and phosphorus fertilizers probably would increase yields.

A plentiful supply of underground water is available at a depth ranging from 20 to 40 feet.

Vanoss fine sandy loam.—Vanoss fine sandy loam is a dark Prairie soil somewhat similar to Durant fine sandy loam. The 12-inch surface soil is dark grayish-brown heavy fine sandy loam containing, in places, a few small indistinct reddish-brown mottlings. In dry exposed cuts this material breaks vertically into large prisms, from 6 to 10 inches in diameter. The surface soil is acid in reaction and contains a moderate amount of organic matter. It grades into dark-brown heavy fine sandy loam that, in places, includes small reddish-brown mottlings associated with small round concretions of iron or manganese. The material is acid in reaction and contains less organic matter than the surface soil. It gives way, at a depth of 20 inches, to mottled gray and yellow acid sandy clay containing a few orange and reddish-brown spots and specks. This material is low in organic matter and, in dry exposed cuts, breaks into irregular prisms or blocks, 1 or 1½ inches in diameter. It grades, at a depth of about 84 inches, into fine sandy clay coarsely mottled or splotched with red, gray, and yellow. According to geologists, this is the Gerty sand formation. It is neutral in reaction.

The principal areas of this soil occur in the northwestern part of the county in the vicinities of Yeager School and Parish Chapel School. Other bodies are 1 mile east and 1 mile north of Summers Chapel School, at Wostell School, and at the west side of Allen. This soil is inextensive. It occupies flat to gently undulating areas, and drainage is good throughout. Prairie grasses, predominantly bluestems, constitute the native vegetation.

Vanoss fine sandy loam is a comparatively fertile sandy soil. It is suited to the production of cotton, oats, peanuts, and cowpeas but is not highly suited for the production of corn. Cotton yields an average of about 130 pounds of lint to the acre, corn 16 bushels, oats 30 bushels, and sorghums 2 tons of forage. About 21 percent of this soil is cropped to corn, 10 percent to oats, 32 percent to cotton, and 13 percent to sorghums, and 20 percent is devoted to pasture and hay. Owing to the slight consistence of the soil, its supply of organic matter is easily depleted by the customary types of farming. Additions of barnyard manure and growing green-manure crops improve the soil and increase production. Fertilizers containing phosphorus and nitrogen probably would increase yields on this soil.

Deep gullies with almost perpendicular sides, which in places are 15 feet deep and from 6 to 8 feet wide, have cut back into some areas of this soil. High levees around the heads of such gullies would help to check their progress. The gullies are generally so deep and narrow that they could not be reclaimed easily for farming.

A plentiful supply of underground water is available at a depth ranging from 30 to 40 feet.

Fitzhugh fine sandy loam.—This is a Reddish Prairie soil intermediate in character between Durant fine sandy loam and Newtonia silt loam. The surface soil, to a depth of about 12 inches, is dark-brown or grayish-brown fine sandy loam, which in dry exposed cuts

cracks vertically into large irregular prisms, from 8 to 12 inches in diameter. This material is rather friable, neutral in reaction, and moderately high in organic matter. It grades into brown or faint reddish-brown fine sandy loam or crumbly clay, which is friable and does not break into prisms. At a depth of about 20 inches, this material, in turn, grades into reddish-brown fine sandy loam or fine sandy clay, which is friable, neutral in reaction, and low in organic matter. Below a depth of 30 inches is mottled gray, yellow, and red fine sandy loam, which is noncalcareous and neutral. Solid sandstone bedrock is reached at a depth ranging from 4 to 8 feet.

A few small bodies of this soil are in the vicinity of Roff. The total area is small.

The native vegetation consists of prairie beardgrass (little bluestem), bluejoint turkeyfoot (tall bluestem), silver beardgrass, and side-oats grama. This soil is moderately productive, but additions of manure or growing green-manure crops help to maintain the productivity. It is said to be not well suited to corn. Cotton yields an average of 125 pounds an acre, corn 15 bushels, oats 30 bushels, and peanuts 20 bushels. About 20 percent of this soil is devoted to cotton, 5 percent to sorghums, 30 percent to corn, and 15 percent to oats; 30 percent is in pasture.

Roff gravelly loam.—Roff gravelly loam is a brown Prairie soil developed from fine gravel conglomerate. It appears to be a prairie equivalent of the Chigley soils. The surface soil, to a depth of about 10 inches, is dark-brown fine gravelly loam, rather friable and easily worked. The reaction is neutral, and the organic-matter content is moderately high. The gravelly material consists mainly of fine and small pebbles of quartz and feldspar. This layer grades into one of brown and dark-brown variegated gravelly loam, which is friable and not platy. This layer contains somewhat less organic matter than the surface soil. It grades, at a depth of 18 inches, into mottled gray, red, and yellow gravelly clay, which is slightly darkened by organic matter and is neutral in reaction. Below a depth of 30 inches is gray and yellow gravelly clay. Bedrock of granitic conglomerate cemented by calcium carbonate lies at a depth ranging from 5 to 8 feet. In some places the lower part of the subsoil is rather gravelly and porous. Roots penetrate to a depth of 50 inches.

The principal areas of this soil occur near the western boundary of the county west of Roff, south of Lightning Ridge School, and north of Union Hill School. It is not extensive. The relief is undulating to gently rolling. The soil is well drained and, in some places, has rapid underdrainage because of the gravelly material. Erosion is rather severe where the soil is unprotected. Terraces and strip crops on cultivated areas appear to prevent excessive erosion.

The native vegetation is prairie grasses, with bluestems, panicgrass, and other bunchgrasses dominant. In a few places scattered post oak and blackjack oak trees represent a slight encroachment from adjacent forested soils. The soil has a moderately high organic-matter content and appears to be more productive than the forested soils for corn and oats. It produces yields of about 13 bushels of corn, 100 pounds of cotton lint, 25 bushels of oats, and 2 tons of sorghum forage to the acre. It also produces good yields of Sudan grass. About 23 percent of this soil is cropped to cotton, 17 percent

to sorghums, 9 percent to oats, 16 percent to corn, and 5 percent to sweetclover; 30 percent is in hay and pasture.

LIGHT-COLORED SOILS OF THE UPLANDS AND TERRACES

The light-colored soils of the uplands and terraces comprise leached sandy soils of moderate to low fertility, developed under a forest vegetation. Originally they were moderately productive, but the fertility has been reduced to a considerable extent through improper farming practices, such as burning crop residues, failure to adopt crop rotations, and use of cropping systems that make no provision for returning organic matter to the soil. The reaction of these soils is acid, and their contents of organic matter, nitrogen, and phosphorus are low. Under virgin conditions there is a 3- or 4-inch surface layer of brown or dark-brown granular fine sandy loam or very fine sandy loam. Under cultivation, the color of the surface soil soon becomes lighter, and to a depth ranging from 6 to 18 inches the material consists of grayish-brown loamy fine sand or very fine sandy loam. The subsoil below this depth is red, yellow, or mottled clay loam or sandy clay, which is distinctly heavier and more highly colored than the surface soil. The lower part of the subsoil is mottled and approaches the underlying rock in color.

Post oak and blackjack oak form the native vegetation. These soils are suited to the production of peanuts, watermelons, cowpeas, cotton, and grapes. Most of the soils are acid in reaction and therefore are not suited to alfalfa and clovers. These soils are, as a rule, not fertile enough for satisfactory yields of corn.

The soils of this group are Hanceville fine sandy loam; Cleburne fine sandy loam; Stidham fine sandy loam; Stidham fine sandy loam, rolling phase; Stidham fine sand; Dougherty fine sandy loam; Buckhorn fine sandy loam; and Chigley fine sandy loam. Hanceville fine sandy loam is a shallow sandy soil with a red subsoil and is developed from sandstone. Cleburne fine sandy loam is a deep sandy soil with a yellow sandy clay subsoil, developed from sandstone. Stidham fine sandy loam is similar to the Cleburne soil but is still deeper. Dougherty fine sandy loam resembles Stidham fine sandy loam, except for its red subsoil. Buckhorn fine sandy loam is similar to Hanceville fine sandy loam but has a slightly darker surface soil and a less red subsoil. The Chigley soils are developed from granitic conglomerate.

Hanceville fine sandy loam.—Hanceville fine sandy loam is a moderately shallow Red Podzolic soil developed from noncalcareous sandstone. It has developed under a native vegetation consisting largely of post oak and blackjack oak trees. The virgin soil has a thin surface layer, about 4 inches thick, of brown loose fine sandy loam that is nearly neutral in reaction. This layer becomes deeper and less dark under cultivation. Below it is grayish-yellow or pale-yellow fine sand, ranging from neutral to acid in reaction. At a depth of about 10 inches this material passes into reddish-yellow friable strongly acid clay or sandy clay, which grades, at a depth of about 22 inches, into yellowish-red acid fine sandy clay or clay loam. Below a depth of 30 inches is mottled gray, red, and yellow fine sandy clay with the gray color predominant. In most places solid bedrock

of sandstone is reached at a depth ranging from 3 to 9 feet. Strata of gray shale also are present in the subsoil.

Included with Hanceville fine sandy loam as mapped are many small areas that have a yellow or gray subsoil.

Hanceville fine sandy loam has a rolling relief. It is developed from sandstone or sandstone and shale interbedded. Both surface and internal drainage are free. The principal areas are east and northeast of Ada, and smaller bodies occur along the bluffs of the Canadian River. The soil covers a large total area. This soil is more subject to damage from erosion than are many of the other soils, because of its steep slopes and moderately heavy subsoil, which lies so close to the surface. Supplies of well water are uncertain.

This soil is not very productive, owing to its shallowness and steep relief. It contains little organic matter, nitrogen, and phosphorus. Fair yields of cotton and peanuts are obtained, however, under good management. Cotton is said to yield an average of about 75 pounds of lint, corn 8 bushels, oats 15 bushels, sorghums 1 ton of forage, and peanuts 5 to 15 bushels an acre. Native pasture grasses growing on this soil are not very nutritious. About 14 percent of the soil is cropped to cotton, 7 percent to corn, 8 percent to sorghums, 8 percent to oats, and 1 percent to sweetclover, and 62 percent is in forest and pasture.

Cleburne fine sandy loam.—Cleburne fine sandy loam is a light-colored Yellow Podzolic soil developed from noncalcareous sandstone. Under virgin forest vegetation this soil is covered by a very thin layer of oak leaves, and the surface soil, to a depth of about 4 inches, is grayish-brown loamy fine sand having loose consistence. This material has a high organic-matter content and is neutral in reaction. In cultivated fields this layer is thicker and lighter colored. The subsurface layer, which continues to a depth of 20 inches, is grayish-yellow fine sand of single-grain structure and in most places is strongly acid in reaction. It rests on brownish-yellow or yellow sandy clay that is moderately compact when dry and friable when moist. In places numerous fine root holes impart a spongelike appearance. The reaction is strongly acid. At a depth of approximately 36 inches this material grades into mottled yellow and rust-brown highly acid fine sandy loam. At a depth of about 50 inches is orange, gray, and yellow mottled fine sandy loam containing fragments of sandstone. Solid bedrock of noncalcareous sandstone occurs at a depth ranging from 5 to 7 feet. Roots penetrate to bedrock.

In places where the color is slightly darker than elsewhere, the soil is generally slightly more productive than the typical soil.

The surface of this soil is gently undulating to almost flat. The soil is very permeable and has good underdrainage and free surface drainage. It occurs on high flat divides in a few areas, principally in the vicinities of Union Valley School and Lula.

The native vegetation is chiefly post oak, blackjack oak, and hickory trees.

The soil is suited to the production of cotton, peanuts, cowpeas, Sudan grass, and watermelons, which are the chief crops. Yields of cotton average approximately 100 pounds of lint an acre. Peanuts yield from 5 to 15 bushels an acre, corn 11 bushels, and oats 26 bush-

els. About 30 percent of this soil is planted to cotton, 5 percent to peanuts, 20 percent to corn, 5 percent to oats, and 10 percent to grain sorghums, and 30 percent is in forest or pasture.

This soil is low in nitrogen, phosphorus, and organic matter but responds very well to additions of fertilizers containing these materials. It also responds very well to rotations that include the plowing under of green manure or the addition of barnyard manure. Erosion has not injured this soil seriously.

Stidham fine sandy loam.—Stidham fine sandy loam is a Yellow Podzolic soil somewhat similar to Cleburne fine sandy loam. The lower part of the subsoil and the substratum consist of a deep bed of sandy clay. The soil has developed mainly under a forest growth of blackjack oak and post oak trees.

The topmost 5 inches of the virgin soil is brown or grayish-brown loose loamy fine sand. The darker color disappears under cultivation. The material is neutral to acid in reaction. It passes into grayish-yellow acid fine sand or fine sandy loam that is low in organic matter. At a depth ranging from 14 to 20 inches this material, in turn, passes into yellow acid fine sandy clay, which, in places, contains a few orange spots. The material in this layer is moderately compact when dry but rather friable when moist. Below a depth of 36 inches it grades into yellow or orange-yellow acid friable fine sandy loam, and this, in turn, grades at a depth of 45 inches into mottled yellow, gray, and red acid fine sandy loam, which continues to a depth ranging from 15 to 20 feet with little change in character. The parent material is the unconsolidated sandy clay deposited by the Canadian River in ancient times, designated by geologists as the Gerty sand of Quaternary age. In a few places the color of the surface layer is darker than typical.

The principal areas of Stidham fine sandy loam occur in the northwestern part of the county between Spring Creek and the Canadian River, and some bodies are near Allen. The surface is gently undulating to nearly flat. Drainage is adequate except during very wet periods, although it is slightly restricted in the subsoil. A plentiful supply of drinking water is obtained in wells ranging from 20 to 30 feet in depth.

Despite the nearly flat surface, gully erosion is a menace on the unprotected soil, as the substratum is loose and easily eroded. Gullies cut back with great rapidity into areas of this soil, and deep narrow gullies have ruined many fields.

This soil is well suited to the production of cotton, peanuts, watermelons, peaches, grapes, cowpeas, and other crops. The acid character of the soil makes it unfavorable to clovers and alfalfa. The soil is deficient in organic matter, nitrogen, and phosphorus, and it responds very well to fertilizers including these materials. Yields of cotton are reported to average about 100 pounds an acre. Corn produces an average of about 11 bushels, oats 25 bushels, peanuts 15 or 20 bushels, and sorghums 1.7 tons of forage an acre. About 23 percent of this soil is cropped to cotton, 18 percent to sorghums, 14 percent to corn, and 1 percent to peanuts, and 44 percent is in forest and pasture.

Stidham fine sandy loam, rolling phase.—Stidham fine sandy loam, rolling phase, is similar to Stidham fine sandy loam but has a

more rolling and sloping relief. It differs from Dougherty fine sandy loam in having a yellow instead of a red subsoil. It is a yellow Podzolic soil.

The virgin soil has a dark surface layer, approximately 4 inches thick, of grayish-brown loose friable acid loamy fine sand, underlain by grayish-yellow acid fine sand. This grades, at a depth of 10 to 15 inches, into yellow sandy clay that contains a few orange spots or specks in places and is rather acid in reaction. The material is friable when moist but hard when dry. At a depth of about 30 inches it grades into yellow or orange-yellow friable acid fine sandy loam. This material, in turn, grades, at a depth of about 40 inches, into mottled yellow, gray, and red acid fine sandy loam, which continues to a depth ranging from 15 to 20 feet without noticeable change.

In some places, particularly at the foot of slopes, this soil is very thick and the sandy clay lies 4 feet or more below the surface. Near the top of slopes the sandy surface soil is very shallow and the sandy clay is exposed by plowing in many places. The soil is so loose that it erodes severely when not protected by trees or other vegetation. A plentiful supply of underground water is present at a depth ranging from 20 to 40 feet.

This soil occurs principally in the northwestern part of the county near Maxwell and around Oil Center.

The soil has little value for the production of crops because of its rolling relief and shallow surface soil. Cotton yields an average of about 65 pounds on acre, corn 8 bushels, peanuts 10 bushels, oats 15 bushels, and sorghums about 1 ton of forage. The consistence is so loose that the soil is not well suited to corn and oats. About 25 percent of the soil is devoted to cotton, 15 percent to corn, 6 percent to oats, 5 percent to sorghums, and 1 percent to peanuts, and 43 percent is in forest and pasture.

Stidham fine sand.—Stidham fine sand is a sandy Yellow Podzolic soil developed on the terraces in the Canadian River Valley. The 8-inch surface soil is grayish-brown fine sand with a single-grain structure and a moderately low organic-matter content. The reaction is neutral. The surface soil grades into grayish-yellow fine sand, which also has a single-grain structure and a neutral reaction, together with a very low organic-matter content. Below a depth of 36 inches this material gives way to light-gray fine sand.

A belt of this soil from one-fourth to one-half mile wide borders the Canadian River Valley from the northwest corner of the county to a point 2½ miles northeast of Oil Center. Smaller areas are east and southeast of Wostell School, 5 miles north of Byng, and 2 miles northeast of Francis. This soil covers a total area of 6.5 square miles.

The soil contains very little organic matter and is evidently deficient in some of the essential plant nutrients. The surface is flat to gently undulating. An abundant supply of good water is obtained in shallow wells.

The native vegetation consists chiefly of forest, and the principal trees are post oak and blackjack oak.

The soil produces fair crops of peanuts, cowpeas, and watermelons. Corn yields are generally low. Cotton yields approximately 55 pounds of lint an acre, peanuts 10 to 15 bushels, corn 7 bushels,

oats 10 bushels, and sorghums 0.8 ton of forage. About 20 percent of this soil is cropped to cotton, 10 percent to corn, and 5 percent to peanuts, and 60 percent is in forest.

Dougherty fine sandy loam.—Dougherty fine sandy loam is a sandy Red Podzolic soil developed from very ancient stream sediments. Under virgin conditions the surface soil, to a depth of 4 inches, consists of brown fine sandy loam or loamy fine sand that has a high organic-matter content and a neutral to acid reaction. The surface layer becomes thicker and lighter in color in cultivated fields. It grades into grayish-brown acid fine sandy loam containing little organic matter. This material, in turn, grades, at a depth of 8 or 10 inches, into pale yellowish-brown fine sandy loam, which, at a depth of about 14 or 15 inches, passes into yellowish-red rather friable sandy clay. The reaction of this material is acid. In places the subsoil below a depth of 4 feet is mottled gray and red sandy clay that continues to a depth ranging from 15 to 20 feet in most places.

This soil occurs on high very old rather flat terraces along the Canadian River. The parent material is Gerty sand. Drainage of both surface soil and subsoil is moderately free. A few small areas are in the northern part of the county in the vicinity of Wostell School and northwest of Galey School; others are in the vicinity of Allen. The total area is not large.

The native vegetation consists of blackjack oak, post oak, elm, hickory, and persimmon trees. Under natural conditions, very little grass grows on this soil. There is little, if any, difference between the agricultural value and utilization of this soil and those of Stidham fine sandy loam. The soil is low in organic matter, nitrogen, and phosphorus, and the use of fertilizers having these constituents generally brings about increased yields. Yields of cotton are reported to average about 105 pounds an acre. Corn yields an average of about 12 bushels an acre, oats 25 bushels, peanuts 15 to 20 bushels, and sorghums 1½ tons of forage. Watermelons and sweetpotatoes do well. About 35 percent of this soil is cropped to cotton, 20 percent to corn, 5 percent to peanuts, and 10 percent to sorghums, and 30 percent is in forest and pasture.

Although the soil occurs on flat divides, it is subject to gully erosion. Very deep narrow gullies cut back into the flat areas because the underlying material is very friable and subject to caving. The water table ranges from about 20 to 30 feet beneath the surface.

Buckhorn fine sandy loam.—Buckhorn fine sandy loam is a sandy forested soil with a fairly dark surface soil. Apparently the soil was developed under prairie types of vegetation, and trees have become established on it at a comparatively recent date. This is a degraded Prairie soil. The vegetation at present consists of blackjack oak, post oak, sumac, redbud, and small-flowered dogwood.

The 12-inch surface soil is dark grayish-brown friable slightly granular fine sandy loam, moderately high in organic matter and neutral in reaction. It grades into reddish-brown heavy fine sandy loam, which, in turn, grades, below a depth of 18 or 20 inches, into red crumbly acid fine sandy clay. This layer continues to a depth of 30 inches, where it changes to yellowish-brown clay with faint red mottlings. This material is neutral in reaction and shows no lines of cleavage. Between depths of 42 and 52 inches is yellowish-red and

reddish-yellow mottled clay containing a few accretions of calcium carbonate. The fine earth is not calcareous. Below this is yellowish-red friable clay with a few calcium carbonate accretions, and below a depth of 60 inches is yellowish-red sandy clay with fine mottlings of gray. This material rests on bedrock of sandstone.

Buckhorn fine sandy loam has smoothly undulating relief. It is moderately fertile and is suited to the production of cotton, Sudan grass, and sorghums. Cotton yields an average of about 115 pounds of lint an acre, corn 14 bushels, oats 27 bushels, and sorghums 2 tons of forage. About 10 percent of this soil is planted to corn, 15 percent to cotton, 7 percent to oats, and 5 percent to sorghums, and 60 percent is in pasture and forest.

This soil covers a small total area principally east of Roff, southeast of Roff, and 4 miles southwest of Fittstown.

Chigley fine sandy loam.—Chigley fine sandy loam is a Red Podzolic forested soil containing considerable granitic gravel in the surface soil and subsoil. The virgin soil has a dark-colored 2- or 3-inch surface layer of brown gravelly fine sandy loam that contains considerable organic matter and is neutral in reaction. Under cultivation this layer becomes lighter colored and thicker. Beneath the surface layer is a layer of yellowish-brown gravelly fine sandy loam about 10 inches thick, containing little organic matter. The gravel consists of fine granitic pebbles of decomposed conglomerate. This material grades into red gravelly clay, which, on drying in exposed banks, separates into roughly cubical blocks about one-half inch in diameter. This material is rather compact when dry but friable when moist. It is strongly acid in reaction and contains a few fine feldspar and quartz pebbles from decomposed conglomerate. The layer is very low in organic matter. It grades, at a depth ranging from 3 to 5 feet, into yellow, red, and black mottled gravelly loam, which represents only slightly weathered parent rock, a consolidated granitic conglomerate cemented with calcium carbonate.

Included with this soil in mapping are numerous variations in color and texture of surface soil and subsoil. The gravel and lime contents of the parent rock are extremely variable; consequently, the resultant soil is very spotted. Plowed fields have small areas of red, yellow, gray, and black surface soil so intimately mixed that it is not practicable to attempt to separate them on the soil map. Areas of this soil near Ada appear to have supported a somewhat heavier growth of grasses in the forest undergrowth than did the typical soil, and in these areas the soil is slightly darker and more productive than elsewhere.

This soil occurs on undulating ridge tops where the surface is comparatively smooth. Surface and subsoil drainage are adequate. The native vegetation is mainly post oak and blackjack oak, with a thin grass cover under the trees.

This soil occurs in many large and small areas within a belt of Chigley gravelly loam, which is approximately 5 miles wide, extending from the western boundary of the county west of Roff in a northeasterly direction to Center. A few isolated areas are near Walnut Grove School and Byng; others are east of Ada.

A large part of this soil is cultivated, owing to the scarcity of arable soil in the vicinity of its occurrence. The gravel and fine peb-

bles in the surface layers do not interfere with cultivation but rapidly dull the cutting edges of tillage implements. Cotton is said to yield about 60 pounds an acre, corn 8 bushels, oats 11 bushels, sorghums 1 ton of forage, and peanuts 5 to 10 bushels. About 16 percent of this soil is cropped to cotton, 8 percent to corn, 9 percent to sorghums, 4 percent to oats, 5 percent to sweetclover, 1 percent to cowpeas, and 2 percent to peanuts, and 53 percent is in forest and pasture. If this soil were associated with better soils, it would probably all be utilized for pasture.

This soil would probably respond favorably to terracing, strip cropping, and the addition of commercial fertilizers. Although erosion is not severe, it does considerable damage in many places.

SOILS OF THE BOTTOM LANDS

The soils of the bottom lands comprise those that occur on or adjoin the flood plains of the streams. Most of these soils are rather fertile and are very productive when crops are not damaged by overflows. The soils are deep and are well drained in most places. Along the smaller streams, however, drainage is deficient in some places but could be improved by straightening and deepening the stream channels. Overflows occur often along these smaller streams and cause considerable damage to crops. They are more rare along the larger streams, and fair to good crops are grown during most seasons. Corn, cotton, and alfalfa are particularly well adapted to these soils. For the most part, the soils are reddish brown and dark brown, neutral in reaction or calcareous, and comparatively fertile. The subsoils consist of stratified sands, clays, and loams of various colors. Underground water is present at a depth ranging from 8 to 25 feet. Verdigris clay loam, Verdigris fine sandy loam, Osage clay loam, Yahola very fine sandy loam, Yahola fine sand, and Teller very fine sandy loam are included in this group.

Verdigris clay loam.—Verdigris clay loam is a brown soil composed of alluvial material, occurring in the first bottoms of many of the streams. The surface soil, to a depth of 10 inches, is brown or dark-brown rather friable silty clay loam. This material has a high organic-matter content and a neutral reaction. The crushed soil aggregates are brown instead of dark brown. The material in this layer grades into slightly less friable brown clay loam that likewise is neutral in reaction and moderately high in organic matter. This material grades, at a depth of 24 inches, into brown and dark-brown mottled clay loam. The reaction in this layer is neutral or slightly alkaline, and the organic-matter content is somewhat lower than in the overlying layers. At a depth of 36 inches, this material passes gradually into brown or slightly reddish brown slightly alkaline rather friable loam, which becomes more sandy with depth.

The subsoil of this soil is rather variable as a result of its mode of deposition. In some places it includes strata of black clay loam and in other places strata of fine sand.

Bodies of this soil occupy the flood plains, chiefly of Spring, Blue, West Blue, Sandy, and Muddy Boggy Creeks, and they aggregate a large total area. The soil is composed mainly of soil materials washed from areas of dark Prairie soils. Although subject to overflow, it is sufficiently well drained to allow successful cultivation.

Ditching is not necessary, but in some places straightening of the stream channel has reduced the danger of overflows. Overflows are more common along the smaller streams. A plentiful supply of underground water, suitable for human use, is present at a depth ranging from 10 to 15 feet.

This soil retains its fertility, even where it is farmed without much attention to improvement. In places, deposits of sand washed from higher land decrease the value of the soil.

The native vegetation consists largely of elm, black oak, sycamore, willow, pecan, walnut, small-flowered dogwood, blackjack oak, post oak, and chestnut oak trees. The soil apparently is well supplied with lime, organic matter, nitrogen, and various essential plant nutrients. It is a productive soil, and yields are good when overflows do not occur during the time crops are most susceptible to damage. Good crops of corn, alfalfa, and sorghums are produced. Yields of corn average about 20 bushels an acre, cotton 145 pounds of lint, sorghums 3 tons of forage, and oats 45 bushels. Some thrifty native and planted pecan trees indicate the suitability of this soil for pecans. Approximately 27 percent of the soil is cropped to corn, 8 percent to sorghums, 11 percent to oats, 8 percent to alfalfa, and 7 percent to cotton, and 39 percent is in forest and pasture.

Verdigris fine sandy loam.—Verdigris fine sandy loam is a soil composed of sandy alluvium occurring along small streams that originate in and drain the sandy soils in various parts of the county. The 14-inch surface soil is brown loose friable faintly alkaline fine sandy loam, with a moderately high organic-matter content. It grades into dark-brown faintly alkaline friable mellow heavy very fine sandy loam. The lower part of the subsoil is extremely variable, as in all alluvial soils. Strata of sand and a dark heavy material are present in the subsoil in many places.

Small areas of this soil occur southwest of Allen, west of Brook Haven School, southwest of Steedman, northeast of Homer School, near Francis, north of Byng, east of Wostell School, and east of Maxwell.

Drainage is moderately free. In places ditching has prevented severe overflows by straightening the stream channels. Well water in ample quantities is obtained at a depth ranging from 10 to 15 feet. In many places a high water table provides natural subirrigation to some extent, and good crops are sometimes produced even in dry seasons.

Corn yields about 20 bushels an acre, cotton 100 pounds of lint, oats 25 bushels, and sorghum 2½ tons of forage. Overflows decrease these yields greatly during some seasons. About 40 percent of this soil is devoted to corn, 25 percent to cotton, and 5 percent to sorghums, and 25 percent is in forest and pasture.

Osage clay loam.—Osage clay loam is a dark soil composed of alluvium. It is developed on the flood plains of some of the creeks. It occurs on rather low bottoms and is subject to overflow. The topmost 12 inches of this soil is very dark brown or black moderately friable clay loam, neutral or slightly alkaline in reaction and very high in organic matter. It grades into black slightly alkaline friable clay that is equally high in organic matter and separates into clods one-half to one-fourth inch in diameter. At a depth of about 32

inches this material grades into black clay containing a few calcareous specks and spots, although the fine earth is not calcareous. The reaction is alkaline. The gray color is intensified with depth.

The principal area of this soil borders Clear Boggy Creek, and smaller areas border Byrds Mill, Sandy, and Spring Creeks. The total area is large. The soil materials have been washed from dark Prairie soils. Good supplies of water are obtained in wells ranging from 10 to 20 feet in depth.

This soil is well supplied with plant nutrients, lime, and organic matter and would be an ideal soil were it not for the injury to crops from overflow. Ordinarily, overflows are not quite so frequent on Osage clay loam as on Verdigris clay loam, since the Osage soil occurs, for the most part, on the wider creek bottoms. Yields of corn average approximately 21 bushels an acre, cotton 145 pounds of lint, oats 45 bushels, alfalfa 3 tons, and sorghums 3 tons of forage. Overflows sometimes reduce yields considerably below those given. This soil is suited to the production of alfalfa and corn. About 14 percent of it is cropped to corn, 16 percent to cotton, 12 percent to sorghums, 10 percent to oats, and 6 percent to alfalfa, and 42 percent is in forest and pasture.

Yahola very fine sandy loam.—Yahola very fine sandy loam, a soil formed from alluvial materials, occurs on the first bottoms of the Canadian River, where it is subject to overflow. Both surface soil and subsoil are rather variable in texture and consistence. The surface soil is brown or reddish-brown calcareous friable very fine sandy loam that does not have any definite structure but is easily kept in good tilth. It grades, at a depth ranging from 18 to 24 inches, into yellowish-brown calcareous fine sandy loam. In some places this material has a red hue. A few small areas of Yahola clay loam are included with mapped areas of this soil.

The principal areas of this soil are southeast of the highway bridge in the extreme northwestern part of the county and in a narrow strip paralleling the river south of the highway bridge north of Ada. The soil borders the Canadian River throughout most of its course along the northern boundary of the county. Although the land is subject to overflow, it is naturally well drained.

The native vegetation was mainly post oak, blackjack oak, elm, black oak, chestnut oak, and willow trees. This is a productive soil and, according to local reports, produces yields about as high as those obtained on any soil in the county. Corn is said to yield 23 bushels an acre, cotton 150 pounds of lint, oats 45 bushels, and sorghums 3 tons of forage. About 40 percent of this soil is cropped to corn, 30 percent to cotton, 10 percent to oats, and 10 percent to alfalfa, and 10 percent is in miscellaneous crops and pasture. Some areas are irrigated by spring water and utilized in the production of truck crops, such as tomatoes, peppers, and sweet corn. Underground water is present at a depth of 10 to 15 feet.

Yahola fine sand.—Yahola fine sand consists of sandy billowy areas of soils composed of alluvial materials, which occur along the banks of the Canadian River and some of its smaller tributaries. The surface soil is brown or reddish-brown fine sand, ranging in thickness from 8 to 20 inches, and it is calcareous in most places. It grades into grayish-yellow calcareous very fine sand, which continues

to a depth of several feet without change. Small spots of Yahola loamy very fine sand are included in mapping.

A very narrow belt of this soil adjoins the Canadian River north of Galey School, northeast of Oil Center, north of Byng, northeast of Francis, and northwest of Allen, totaling a small area. The soil is subject to overflow but is well drained. Forestry and pasturage are its principal uses, as it is too loose and sandy for the production of cultivated crops. A dense growth of trees, largely elm, chinquapin oak, pecan, willow, blackjack oak, post oak, and black oak, forms the native vegetation.

Teller very fine sandy loam.—Teller very fine sandy loam is a soil of the terraces, developed in a few places in the Canadian River Valley at an elevation slightly above overflow. The 18-inch surface soil is brown or dark-brown friable very fine sandy loam, with a moderately high organic-matter content. It grades into reddish-brown friable heavy very fine sandy loam or fine sandy clay, which, in turn, grades, below a depth of about 36 inches, into a looser material of yellowish-red heavy very fine sandy loam. The reaction is neutral throughout.

This is an inextensive soil. The largest area is 2 miles northeast of Maxwell. Small areas are in sec. 6 T. 5 N., R. 4 E., 1 mile west and 5 miles north of Byng, 2 miles northeast of Francis, and 3 miles northwest of Allen. The surface is flat to gently undulating.

Teller very fine sandy loam produces good yields without special care given to increase productivity or to prevent erosion. All crops grown in the county are adapted to this soil and yield above the average obtained on any other soil. Corn is said to yield an average of 26 bushels an acre, cotton 175 pounds of lint, oats 50 bushels, peanuts 25 bushels, and sorghums 3 tons of forage. Approximately 40 percent of this soil is cropped to corn, 35 percent to cotton, 15 percent to oats, and 5 percent to sorghums. About 5 percent is in pasture.

Good well water is obtained at a depth ranging from 10 to 20 feet.

SHALLOW SOILS OF THE UPLANDS

The group of shallow soils of the uplands includes both grassland and forested soils formed on the rolling uplands. They have thin surface soils, either as a result of erosion or because the parent material develops very slowly into soils on the rolling surfaces where run-off is rapid. Unwise cultural practices have accelerated erosion to such an extent that some of the soils are now of low productivity. The surface soils are for the most part moderately light colored. Plowing exposes the subsoil in many places. Most of these soils are cultivated to some extent, but yields generally are not very high. The soils are better suited to the production of hay, pasture, and timber than to cultivated crops. This group includes Chigley gravelly loam; Dougherty fine sandy loam, shallow phase; Durant very fine sandy loam, eroded phase; Denton clay loam; Vernon clay; and Roff gravelly loam, shallow phase.

Chigley gravelly loam.—Chigley gravelly loam consists of rolling forested land containing considerable granitic pebbles and fragments from decomposed conglomerate. The topmost 2 or 3 inches of the virgin soil is grayish-brown or dark-brown loose gravelly loam, the gravelly material consisting mainly of fine gravel of quartz

and feldspar. The dark color disappears when the soil is cultivated. This material grades into yellowish-brown clay loam or clay, which contains some quartz, chert, and feldspathic gravel. Below a depth of approximately 12 inches is yellowish-brown or red highly acid clay that is moderately friable when moist and hard when dry. At a depth of about 20 inches this material grades into red or reddish-brown and gray mottled highly acid clay loam. The red color is predominant in the upper part of this layer, whereas the gray color is dominant and the red mottlings are less numerous below a depth of 30 inches. The reaction is either acid or alkaline. This material grades into bedrock of consolidated granitic conglomerate comprising fragments of granite cemented by calcium carbonate.

The parent material is extremely variable in its contents of gravel and calcium carbonate, and therefore the resulting soil is rather spotted, a fact that is very noticeable in plowed fields. These spots are gray, red, yellow, or black and, although distinct, are not large enough to show on a small-scale map.

A belt of this soil, approximately 5 miles wide, extends from the county boundary west of Roff in a northeasterly direction to the center of the county, aggregating a large total area. The surface is very rolling, and drainage is rather free. Erosion is severe where the native forest has been removed.

The native vegetation consists of post oak, blackjack oak, and hickory trees. Owing to its strongly rolling relief, the soil is not very well suited to the growth of cultivated crops. It is shallow and gravelly and probably deficient in phosphorus, nitrogen, and organic matter. Cotton is said to yield an average of about 50 pounds of lint an acre, corn 6 bushels, oats 10 bushels, and sorghums 0.7 ton of forage. Approximately 5 percent of this soil is cropped to sorghums, 6 percent to cotton, 9 percent to corn, and 2 percent to oats, and 76 percent is in forest and pasture.

Dougherty fine sandy loam, shallow phase.—Dougherty fine sandy loam, shallow phase, is a Red Podzolic soil with a red subsoil, developed from very old river sediments. In virgin areas the 2-inch surface soil is dark grayish-brown loamy fine sand, neutral in reaction. It grades into light grayish-yellow fine sand, with a single-grain structure, very low organic-matter content, and acid reaction. At a depth ranging from 8 to 12 inches this material, in turn, grades into yellowish-red acid sandy clay that is hard when dry and friable when moist. This gives way gradually, at a depth of about 36 inches, to reddish-yellow acid friable fine sandy loam, mottled in places with gray and yellow in the lower part. This layer continues to a depth ranging from 10 to 20 feet without appreciable change. It represents only river deposits, called Gerty sand. In some places a deep loose sand lies below a depth of 4 to 5 feet.

This soil is variable in thickness, the surface soil being very shallow near the top of the slopes and thicker near the foot. Most of it, however, is rather shallow where cultivated. In places the red sandy clay subsoil lies within 3 or 4 inches of the surface.

This soil occurs in the northern part of the county, particularly in the areas bordering Spring Creek and near the Canadian River. Other important areas are in the vicinity of Allen and east of Wostell School. The total area is large. This soil has rolling to sloping

relief, is well drained, and is highly erodible. The native vegetation is post oak and blackjack oak. Plentiful supplies of water are present at a depth ranging from 30 to 40 feet.

This is a rather sandy and shallow soil, and, therefore, it is not very productive. Some of the more level areas are cultivated. Cotton yields an average of about 65 pounds of lint an acre, peanuts 10 bushels, corn 8 bushels, oats 12 bushels, and sorghums 1 ton of forage. About 20 percent of this soil is cropped to cotton, 14 percent to corn, 1 percent to peanuts, 11 percent to sorghums, 7 percent to oats, and 6 percent to sweetclover, and 41 percent is in forest and pasture.

This soil is very susceptible to damage by both sheet and gully erosion. The loose surface soil washes easily, and the lower part of the subsoil is so loose that deep gullies form readily when the soil is cultivated.

Durant very fine sandy loam, eroded phase.—Durant very fine sandy loam, eroded phase, is similar to Durant very fine sandy loam, but it is much more shallow as a result of severe erosion. The surface soil, to a depth of 6 to 8 inches, is brown very fine sandy loam, neutral in reaction and moderately high in organic matter. This material breaks into prisms, 6 to 8 inches in diameter, where exposed in dry cuts, but it is friable when moist. It grades into yellow moderately friable clay or fine sandy clay, slightly mottled with gray. This material is low in organic matter. At a depth of 16 to 18 inches it passes into yellowish-brown clay, in many places mottled with gray, which rests on consolidated sandstone and interbedded shales at a depth ranging from 4 to 6 feet.

This soil occupies rolling and sloping relief and is generally gullied to some extent. Both surface and internal drainage are free. The principal areas are in the vicinities of Stonewall and Jesse, and smaller bodies are near Owl Creek School, Lovelady School, Hall Hill School, and Haskell School, and west of Roff. The soil covers a large total area.

The native vegetation consists of prairie grasses, with bluestems dominant. The soil generally occurs on such steeply sloping surfaces that much of its surface soil has eroded, and therefore it is not well suited to the production of farm crops. It can be made to produce fair crops by terracing, strip cropping, and growing green-manure crops. Yields of oats range from 5 to 30 bushels an acre, with an average of about 18 bushels, sorghums about 1 ton of forage, cotton 60 pounds of lint, and corn 8 bushels. About 13 percent of this soil is cropped to cotton, 10 percent to corn, 8 percent to sorghums, 2 percent to sweetclover, and 7 percent to oats, and 60 percent is in hay and pasture. The carrying capacity of the native pasture is said to be 4½ acres for one cow.

Denton clay loam.—Denton clay loam is similar to Denton clay loam, deep phase, but is more shallow and eroded. It is a brown soil developed from limestone and calcareous shale. The 6-inch surface soil is brown granular clay loam that is calcareous in most places. Below this is olive or yellowish-brown calcareous clay, which grades into limestone or calcareous shale at a depth of 3 to 5 feet. Both the surface soil and the subsoil are friable. In many places the clay subsoil is exposed by erosion.

The principal areas occur in a discontinuous belt, approximately 1 mile wide, extending in a northwest-southeast direction from

Harden City. Many small areas are in the vicinity of Gaar Corner and westward and southwestward from that place to the county line. This is not an extensive soil. It occurs on steep valley slopes where erosion has prevented the formation of a normal soil. Drainage and run-off are excessive.

The native vegetation consists largely of buffalo grass, blue grama, and bluestems. Cotton averages about 65 pounds of lint to the acre, corn 9 bushels, oats 20 bushels, and sorghums 1 ton of forage. The soil is not well suited to the production of cultivated crops and is, in most places, utilized for pasture. About 10 percent of it is devoted to cotton, 5 percent to sorghums, 7 percent to corn, and 8 percent to oats, and 70 percent is in hay and pasture. The carrying capacity of pasture is reported to be 4½ acres per cow.

Vernon clay.—Vernon clay is a heavy red soil developed from limestones and red shales. It is a Lithosol. The surface soil, to a depth of 2 inches, consists of dark reddish-brown clay and breaks into thin horizontal plates or laminations. These plates are fragile and easily broken into fine flattened clods. This material is neutral in reaction, moderately high in organic-matter content, friable when moist, and sticky when wet. It grades into a slightly darker reddish-brown waxy very heavy clay that breaks into irregular thick plates when dry. The organic-matter content of this layer is moderately high. The reaction is slightly alkaline, but the material is not calcareous. It is moderately friable when moist but rather hard when dry. This material grades, at a depth of 7 inches, into reddish-brown heavy clay that is tough and plastic when moist, and hard and vitreous when dry and, in places, is calcareous. The breakage is very irregular, and the organic-matter content is low. This passes, at a depth of 20 inches, into reddish-brown clay containing a few whitish calcium carbonate accretions and a few flattened shale fragments. The fine earth is calcareous. At a depth of about 36 inches this material, in turn, grades into brownish-red or red highly calcareous shale, with a few spots and streaks of bluish-gray shale.

Roots penetrate to a depth of 36 inches. In some places the red shales are interbedded with limestone, and in a few places sandstone outcrops. The soil appears to be developed principally from red shales of the Permian "Red Beds."

Vernon clay occurs only in the northwestern part of the county. The principal areas extend from the northwestern corner to Egypt School. Other areas are southwest of Summers Chapel School, and near Parish Chapel School. The land is rolling to steeply sloping, and in places it is so rough that cultivation is almost impossible. The soil is freely drained on the surface and is deeply gullied in places.

The native vegetation is buffalo grass, blue grama, side-oats grama, and bluestems. Some areas support a scattered growth of post oak and blackjack oak trees.

Rain water does not sink readily into the surface soil and subsoil, but runs off rapidly; therefore, little moisture is stored for dry seasons. The more level and less eroded areas are cultivated and produce fair yields of corn and oats. Corn yields about 11 bushels an acre, oats 20 bushels, sorghums 1 ton of forage, and cotton 65 pounds of lint. Approximately 14 percent of this soil is cropped to

corn, 4 percent to sorghums, 8 percent to cotton, and 4 percent to oats, and 70 percent is in hay and pasture.

Roff gravelly loam, shallow phase.—Roff gravelly loam, shallow phase, is a Prairie soil developed from granitic conglomerate. It is associated with typical Roff gravelly loam, from which it differs in being more shallow, more rolling, and more steeply sloping. The topmost 4- to 8-inch layer consists of dark-brown gravelly loam or gravelly clay that is not very friable, is neutral in reaction, and does not have a definite structure, except for a slightly prismatic breakage. The gravel consists of small fine granitic pebbles. This layer grades into one of yellowish-brown or brown and red mottled clay that is neutral in reaction and rather hard when dry. The lower part of the subsoil is variable but in most places is made up of gray and yellow gravelly clay or clay. It is calcareous in some places.

The soil covers a very small total area. The principal bodies are near Gaar Corner and west of Roff. The soil largely represents abandoned cropland that is now either idle or is utilized as pasture. Although the soil is not suited to cultivation, owing to its shallowness and eroded condition, small areas are cultivated, on which are reported acre yields of 6 bushels of corn, 40 pounds of lint cotton, 8 bushels of oats, and 0.5 ton of sorghum forage.

NONARABLE SOILS AND LAND TYPES

Extensive areas in Pontotoc County are designated as nonarable soils and land types because they are physically unsuited to cultivation. They are, for the most part, adapted to grazing and forestry and are used entirely for those purposes. This group includes Crawford stony loam, Denton stony clay loam, rough stony land (Denton soil material), rough stony land (Hector soil material), Talihina very fine sandy loam, riverwash, and quarries.

Crawford stony loam.—Crawford stony loam is a smooth stony soil, or Lithosol, associated with Newtonia silt loam. The stone consists of dolomitic limestone, locally called flint. The soil material is brown or reddish-brown friable silt loam ranging in thickness from a mere film to about 18 inches. The reaction is neutral. This layer contains a large quantity of small and large limestone fragments and rests on limestone bedrock.

Areas of Crawford stony loam occur on the divides and, in a few places, in more sloping areas along the streams in the drainage basins of Blue and West Blue Creeks, east and southeast of Roff. The total area is large.

Prairie grasses, largely bluestems, with some buffalo and grama grasses, provide good pasture for livestock on this soil, at the rate of 5 acres to a cow. Large cattle ranches include areas of this soil and the associated Newtonia silt loam. In most places the land is too shallow and rocky for cultivation and generally is utilized only for pasture. The rocks interfere with mowing machines and make it impossible to cut hay.

Denton stony clay loam.—Denton stony clay loam is a smoothly rolling stony soil, or Lithosol, underlain largely by limestone. The 6- to 8-inch surface soil is dark-brown calcareous clay loam, underlain, to a depth ranging from 12 to 18 or more inches, by brown or yellow highly calcareous clay. In some places this soil material is several

feet thick, but in most places much of it has been removed by erosion. A good growth of bluestems, buffalo grass, and grama covers the land.

This soil occurs in a few widely scattered areas, principally in the vicinity of and 7 miles southeast of Fittstown and in the vicinity of Lawrence. Large limestone boulders and outcrops are so numerous in most places that the growth of cultivated crops is impossible, and the land is used only for pasture. It has a carrying capacity of about 4½ acres per cow.

Rough stony land (Denton soil material).—Rough stony land (Denton soil material) consists of steeply rolling rocky hills and slopes of limestone that are unsuited to the production of cultivated crops. The soil material between the rocks is dark-brown calcareous clay or clay loam, which ranges from a few inches to several feet in thickness. This soil material supports a fair growth of bluestems and other prairie grasses. Scattered trees, largely blackhaw, hackberry, and winged elm, grow in places.

Grazing is the only use made of this land, and large cattle ranches are situated on it. An almost unbroken belt, ranging from 1½ to 3 miles in width, extends in a northwesterly direction from the southeastern corner of the county to a point 2 miles west of Lawrence. A few small bodies are in other parts of the county. This land covers a large total area.

Rough stony land (Hector soil material).—Rough stony land (Hector soil material) consists of rough, broken, and stony forested areas. The stone does not occupy a very large proportion of the land but is scattered over the surface and outcrops to such an extent that cultivated crops cannot be grown. The soil material between the rocks is Hector fine sandy loam, but it is very shallow in most places.

The surface soil, to a depth of 4 inches, is brown or grayish-brown rather friable sandy loam that is neutral in reaction. Below is grayish-yellow or pale-yellow fine sand, which grades into yellowish-red friable clay at a depth of 8 or 10 inches. In most places this layer rests on disintegrated sandstone. In the more shallow areas a red color has not developed in the subsoil, which, in such areas, is gray. Rock outcrops are largely sandstone, but in a few places they are granitic conglomerate. Small limestone areas are also included.

The soil occurs in large areas in the central and eastern parts of the county. The larger areas are southeast and northeast of Lovelady School, near Happyland School, Leeda School, Hi-Hill School, and Hall Hill School, and bordering the Canadian River north of Byng and northwest and east of Francis. Other important areas are near Kalihoma Indian School and Brook Haven and Red Oaks Schools. The total area exceeds that of any other soil or land type in the county. In most places the tree growth of post oak, blackjack oak, hickory, and elm prevents much grass growth. In the less thickly forested spots the grasses are coarse bunchgrasses.

Talihina very fine sandy loam.—Talihina very fine sandy loam is a forested soil developed from noncalcareous gray shale. The surface soil, to a depth of about 5 inches, is gray acid loose friable very fine sandy loam containing a few flattened gray shale particles. It grades into strongly acid gray fissile shale. The entire soil is low in organic matter, lime, and probably also in available phosphorus. In places the surface soil is underlain by yellow very fine sandy loam,

which, below a depth of 10 inches, passes into yellow silty clay. This material rests on shale beds at a depth ranging from 1 to 2 feet.

The native vegetation consists of post oak, blackjack oak, hickory, winged elm, and sumac, and the tree roots are confined to the topmost 5 or 6 inches of the soil. There is very little grass.

This soil occurs in a few small scattered areas, the largest of which are 3 miles northeast of Rocky Chapel School, 1 mile southeast of Pleasant Hill School, and 3 miles south of Fittstown. Forestry is about the only use for this soil, as it does not support much grass and is too shallow for growing cultivated crops.

Riverwash.—Riverwash consists of beds of sandy or heavier materials along the banks of the Canadian River. The soil supports a few willows but lies too low for the production of cultivated crops, as its position only a few feet above the bed of the river subjects it to occasional overflow. It is not suited for forestry or for grazing, and its only value is for the sand and gravel it provides for road building and concrete construction. Bodies of this land type occur north of Byng, northeast of Francis, and west of Allen. The aggregate area is very small.

Quarries.—Near Lawrence three small areas of limestone and shale quarries are mapped. These materials are used in the manufacture of portland cement.

PRODUCTIVITY RATINGS

In table 5 the soil types, phases, and miscellaneous land types in Pontotoc County are rated according to their productivity for each of the important crops grown and according to their general productivity. They are listed in the order of their general productivity under prevailing farming practices, which do not include the use of amendments or improved practices of erosion and water control.

The rating compares the productivity of each of the soil types or other mapping units in the county for a given crop to a standard, which represents the approximate average yield obtained without the use of amendments on the more extensive of the better soil types of the region in which the crop is most widely grown. The standard is given an index of 100. A soil estimated to be about half as productive for the specified crop as a soil with the standard index receives an index of 50. Soils given amendments, such as lime, commercial fertilizers, or irrigation, or unusually productive soils of limited acreage will have indexes above 100 for some crops.

The following tabulation gives the more important crops of the county and the acre yield that has been set up as a standard of 100 for each crop.

Crop:		
Corn (grain)	bushels	50
Oats	do	50
Cotton	pounds	400
Sorghum fodder	tons	4
Pasture	cow-acre-days[1]	100

[1] Cow-acre-days is a term used to express the carrying capacity of pasture land. It is the product of the number of animal units carried per acre multiplied by the number of days the animals are grazed without injury to the pasture. For example, the soil type able to support 1 animal unit per acre for the entire year rates 360, whereas another soil able to support 1 animal unit on 2 acres for 180 days of the year rates 90. Again, if 4 acres of pasture support 1 animal unit for 100 days the rating is 25.

TABLE 5.—*Productivity rating of soils in Pontotoc County, Okla.*

Soil [1]	Crop productivity index [2] for—					General productivity grade [3]	Land classification [4]	Principal crops, types of farming, or present use of land
	Corn	Cotton	Oats	Sorghum forage	Native pasture			
Teller very fine sandy loam	50	45	100	75	50	5	Fair to good cropland.	Corn, cotton.
Summit clay loam	45	35	90	70	100			Oats, cotton, corn.
Yahola very fine sandy loam	45	35	90	75	40	6		Corn, cotton, alfalfa.
Osage clay loam	40	35	90	75	40			Pasture, cotton, corn.
Verdigris clay loam	40	35	90	75	40			Pasture, corn, oats.
Denton clay loam, deep phase	40	35	75	60	90			Pasture, cotton, oats, corn.
Parsons very fine sandy loam	35	35	90	55	90			Oats, cotton, corn.
Durant very fine sandy loam	35	30	70	60	80			Pasture, cotton, corn, oats.
Vanoss fine sandy loam	30	30	60	50	70			Cotton, corn.
Brewer very fine sandy loam	30	30	60	50	70			Corn, cotton.
Durant fine sandy loam	30	30	60	50	70			Corn, pasture, cotton.
Fitzhugh fine sandy loam	30	30	60	50	70			Do.
Verdigris fine sandy loam	40	25	50	50	30	7		Do.
Buckhorn fine sandy loam	30	30	55	50	40			Timber and pasture, cotton, corn.
Newtonia silt loam	25	20	60	40	90			Pasture.
Roff gravelly loam	25	25	50	50	70			Pasture, cotton, sorghum.
Dougherty fine sandy loam	20	25	50	40	30			Cotton, timber and pasture, corn.
Cleburne fine sandy loam	20	25	50	40	30			Do.
Stidham fine sandy loam	20	25	50	40	30			Timber and pasture, cotton sorghums.
Vernon clay	20	15	40	25	75			Pasture, corn.
Denton clay loam	15	15	40	25	80	8		Pasture, cotton.
Hanceville fine sandy loam	15	20	30	25	30			Timber and pasture, cotton.
Durant very fine sandy loam, eroded phase.	15	15	35	25	70			Pasture, cotton, corn.
Stidham fine sandy loam, rolling phase.	15	15	30	25	30		Poor cropland	Timber and pasture, cotton, corn.
Dougherty fine sandy loam, shallow phase.	15	15	25	25	30			Do.
Chigley fine sandy loam	15	15	20	25	20			Timber and pasture, cotton.
Roff gravelly loam, shallow phase.	10	10	15	10	60			Pasture.
Stidham fine sand	15	15	20	20	15			Timber and pasture, cotton, corn.
Chigley gravelly loam	10	10	20	15	20	9		Timber and pasture.
Yahola fine sand	10	10	15	10	60			Do.
Denton stony clay loam	----	----	----	----	80		Grazing land	Pasture.
Crawford stony loam	----	----	----	----	70			Pasture, corn.
Rough stony land (Denton soil material).	----	----	----	----	70			Pasture.
Rough stony land (Hector soil material).	----	----	----	----	30		Forest land	Timber.
Talihina very fine sandy loam	----	----	----	----	10	10		Do
Riverwash	----	----	----	----	10			Waste, except as source of sand and gravel.
Quarries	----	----	----	----	----			Waste, except as source of limestone and shale.

[1] Soils are listed in the approximate order of their general productivity under the better current practices, the most productive first.

[2] Soil types inherently most productive for the specified crop in the United States are given the index 100. The soils in Pontotoc County are given indexes that give the approximate production in percent of the standard. Indexes are based on yields of average years.

[3] This classification indicates the comparative general productivity of the soils under the prevailing better current practices. Refer to the text for further explanation.

[4] This is a general classification to bring out local comparisons of productivity of the soils of Pontotoc County in simple terms. The terms "Fair to good cropland," etc., as used here, have only local reference, and are not used on a national basis such as the grade numbers in the preceding column. The delineation of areas of land classes in a given county is a distinct and supplemental step to this type of characterization of soil types. The pattern of distribution of soil types is an influential factor in the delineation of areas.

The principal factors determining the productivity of land are generally stated to be climate, soil (this includes a long list of physical, chemical, and biological characteristics), slope, drainage, and management. Actually, no one of these factors operates distinctly from the others, although some one may dominate. The soil itself is conceived by the modern soil scientist to represent the combined expression of all those forces and factors that, working together,

produce the medium in which the plant grows. Crop yields over a long period of years furnish the best available summation of these associated factors and, therefore, are used where available. In Pontotoc County the yields are based on studies of the soil profile, inquiries among farmers, and data of the Agricultural Adjustment Administration, and they represent a fairly accurate decision regarding the relative productivity of each soil.

Certain modifying practices, such as terracing, contour farming, irrigating, growing legumes, and adding manure, phosphorus, or nitrogen-bearing fertilizers, may increase the value of many of the soils for cultivated crops. The figures given in table 5 are based on prevailing practices that do not include these improved methods.

The soils are listed in the order of their general productivity under the prevailing current practices as determined by the weighted average of the crop indexes. The weighted average has been based both on the areal extent of the individual crops and on the comparative total value.

The marked differences in the suitabilities and uses of different soils because of different soil characteristics makes it inadvisable to use a uniform set of weightings of crop indexes to determine the general productivity grades of all the soil types. Instead, separate weightings of crop indexes were set up for each of five general soil conditions, as indicated in table 6.

TABLE 6.—*Percentage weights given to crop indexes to aid in the determination of the general productivity grades*

Crop	Dark-colored soils	Light-colored soils	Soils of the bottom lands	Shallow soils	Nonarable soils and land types
Corn	25	15	35	15	----
Cotton	35	40	35	20	----
Oats	15	5	10	5	----
Sorghum forage	15	15	10	15	----
Native pasture	10	15	10	20	30

Since it is difficult to measure mathematically either the exact significance of a crop in local agriculture or the importance and suitability of certain soils for particular crops, these weightings for indexes were used only as guides. Certain modifications in the general ranking of the soils according to personal judgment have been permitted.

In table 5, in addition to listing the soils in the order of their general productivity according to prevailing farming practices, productivity grade numbers are assigned in the column, under "General productivity grade," according to prevailing current practices. These are based also on the weighted average of the crop indexes. If the weighted average falls between 90 and 100, the soil type is assigned a grade of 1; if the weighted average falls between 80 and 90, a grade of 2 is given, etc. In Pontotoc County, it is to be noted that the highest general productivity grade number is 5, indicating that the weighted average is between 50 and 60.

The column "Land classification" summarizes in a simple way the productivity and use capabilities of the various soils, by placing them in a few groups on the basis of local reference regarding their relative suitability for farming, grazing, or forestry.

Productivity tables do not present the relative roles that soil types, because of their extent and the pattern of their distribution, play in the agriculture of the county. The tables give a characterization to the productivity of individual soil types. They cannot picture the total quantitative production of crops by soil areas without the additional knowledge of the acreage of the individual soil types devoted to each of the specified crops.

It should be emphasized that these productivity ratings cannot be interpreted directly into land values except in a very general way. Other factors—geographic, economic, and social—have great influence in determining land values. Among these are distance to market, transportation facilities, relative prices of farm products, and many others.

Farmers in this section have learned by experience that certain types of land are suited to certain crops. The suitability of a farm for a certain crop does not necessarily make it advisable for the farmer to plant that crop. Diversification of farm enterprise, crop rotation, and economic considerations are also important in the selection of crops to be grown.

TABLE 7.—*Percentage of cultivated land of each soil and land type devoted to specified crops in 1936, in Pontotoc County, Okla.*

Soil type	Proportion of cultivated land devoted to—						
	Corn	Cotton	Oats and wheat	Peanuts	Sorghum and sugarcane	Pasture and timber	Alfalfa
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Hanceville fine sandy loam	7	14	8	-------	8	62	-------
Cleburne fine sandy loam	20	30	5	5	10	30	-------
Yahola very fine sandy loam	40	30	10	-------	5	5	10
Yahola fine sand	-------	-------	-------	-------	-------	100	-------
Talihina very fine sandy loam	-------	-------	-------	-------	-------	100	-------
Chigley fine sandy loam	8	16	4	2	9	53	-------
Chigley gravelly loam	9	6	2	-------	5	76	-------
Stidham fine sandy loam	14	23	-------	1	18	44	-------
Stidham fine sandy loam, rolling phase	15	25	4	1	5	48	-------
Stidham fine sand	10	20	-------	5	-------	60	-------
Dougherty fine sandy loam	20	35	-------	5	10	30	-------
Dougherty fine sandy loam, shallow phase	14	20	7	1	11	41	-------
Buckhorn fine sandy loam	10	15	5	-------	5	60	-------
Durant fine sandy loam	30	20	15	5	5	25	-------
Durant very fine sandy loam	14	25	14	-------	11	36	-------
Durant very fine sandy loam, eroded phase	10	13	7	-------	8	60	-------
Newtonia silt loam	5	5	5	-------	5	80	-------
Crawford stony loam	-------	-------	-------	-------	-------	100	-------
Vernon clay	14	8	4	-------	4	70	-------
Summit clay loam	16	21	30	-------	7	26	-------
Denton stony clay loam	-------	-------	-------	-------	-------	100	-------
Fitzhugh fine sandy loam	30	20	15	-------	5	30	-------
Denton clay loam, deep phase	15	22	16	-------	10	37	-------
Denton clay loam	7	10	8	-------	5	70	-------
Roff gravelly loam	16	23	9	-------	17	30	-------
Roff gravelly loam, shallow phase	-------	-------	-------	-------	-------	100	-------
Parsons very fine sandy loam	20	20	30	-------	10	20	-------
Teller very fine sandy loam	40	35	15	-------	5	5	-------
Verdigris clay loam	27	7	11	-------	8	39	8
Osage clay loam	14	16	10	-------	12	42	6
Verdigris fine sandy loam	40	25	-------	-------	5	25	-------
Rough stony land (Hector soil material)	-------	-------	-------	-------	-------	100	-------
Rough stony land (Denton soil material)	-------	-------	-------	-------	-------	100	-------
Riverwash	-------	-------	-------	-------	-------	100	-------
Vanoss fine sandy loam	21	32	10	-------	13	20	-------
Brewer very fine sandy loam	40	20	10	-------	10	10	-------

Table 7 has been prepared to show the percentage distribution of crops on each soil type in the county during the crop season of 1936.

These figures were obtained by preparing a crop map of approximately 100,000 acres in the county and comparing the soil map with the crop map.

An examination of the table of land utilization makes it evident that a great deal of land is being cropped that is better suited for pasture. As a matter of fact, the crops are grown almost indiscriminately on all types of soil that can be cultivated, except alfalfa, which is grown only on alluvial soils, and peanuts, which are grown only on loose sandy soils.

A number of farmers in this county have constructed terraces on their land to aid in reducing run-off and erosion. These have proved very successful where the terraces were made at proper intervals and of sufficient height, and where contour farming was practiced after construction of the terraces. Strip cropping has not been used to a great extent but would doubtless be of considerable value. Farm land that once was considered submarginal for crop production has been so improved by terracing that profitable crops now are produced.

Fertilizers are used to a limited extent, and phosphorus and nitrogen fertilizers seem to be of value during years when crops bring a fair price. Several farmers have reported large increases in yields following a green-manure crop of sweetclover.

RECOMMENDATIONS FOR THE MANAGEMENT OF THE SOILS OF PONTOTOC COUNTY[4]

An extensive system of farming, including the cultivation of such crops as cotton, corn, and small grains, has been practiced on most of the arable land in this area ever since the land was put into cultivation. Little effort was made to control soil erosion until some of the more erodible soils had been severely damaged and many fields on the shallower soils had been abandoned. Erosion of surface soil and the growth of crops without thought of maintaining soil fertility have decreased the quantities of organic matter, nitrogen, and phosphorus in the average cultivated soil, as shown in table 8.

TABLE 8.—*Losses of plant nutrients from soils in Pontotoc County, Okla., as a result of cultivation*

[Average of 23 comparisons]

Condition of soil	Nitrogen	Phosphorus	Organic matter
	Pounds[1]	*Pounds*[1]	*Pounds*[1]
Virgin	2,075	460	51,600
Cropped	1,350	390	27,200
Loss through cultivation	725	70	24,400

[1] Pounds per acre 6⅔ inches deep.

The results of the analyses given in table 8 show that 35 percent of the nitrogen originally present in the virgin soils has been lost as a result of cultivation, and more than 47 percent of the organic matter has disappeared. The total content of phosphorus also has decreased, owing to the combined effect of cropping and loss of sur-

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face soil by erosion. One of the most important problems facing the farmers in Pontotoc County at present is to develop cropping systems that will tend to offset these losses. When the prices of cotton and grain are low, it is difficult for farmers to purchase commercial fertilizers that may be needed to increase crop production on many soils. Unless the content of plant nutrients of a large proportion of the cultivated soils can be increased, crop yields and farm income will continue to be low. Such a condition has an important effect on standards of living. Recommended methods to improve the productivity of the soils in this county vary from type to type.

A study of the available phosphorus in 82 samples of soil collected from different parts of the county shows that 9 samples were very high and 19 samples were high in this important element. Soils that are high or very high in easily soluble phosphorus will produce maximum yields of crops like corn, cotton, or alfalfa, without fertilization. The important problem on soils that are high in available phosphorus is to maintain the organic matter and nitrogen content of the soil. This can be accomplished by using legume crops in a cropping system. Of the remaining samples of soil, 9 contained a medium amount of available phosphorus, 15 were low, and 30 were very low in this nutrient. Soils that are low to very low in available phosphorus will respond to phosphorus fertilization for practically all field crops grown in this county.

In most instances, soils deficient in easily soluble phosphorus contain a smaller quantity of this material in the subsurface layers than in the surface soil; consequently subsoils that have been exposed as a result of erosion are nonproductive. This is one reason why soil conservation is such an important problem on the sloping land in this county. Where most of the fertility is in the surface soil and the surface soil is removed by erosion, productivity declines to a very low level. Under such conditions soil improvement is a slow and expensive process.

Soil acidity is not an important limiting factor in the development of a soil-improvement program in most of the soils of this county. The limited effect of leaching and the presence of calcareous parent material on which soils have developed are responsible to a very great extent for this condition. Analyses were made to determine the variation in soil reaction in 156 samples of soil from different parts of the county, 105 of which were basic in reaction and would not respond to applications of limestone for lime-loving crops, such as sweetclover or alfalfa. Of these 105 samples, 68 contained varying amounts of free calcium carbonate and 37 soils were neutral. The remaining 51 samples analyzed as follows: 18 slightly acid, 11 slightly acid +, 12 medium acid, 3 medium acid +, and 7 strongly acid. According to these analyses, sweetclover could be grown as a crop for soil improvement on approximately two-thirds of the cultivated land in Pontotoc County so far as soil acidity is concerned, although phosphorus fertilizers will be needed on some of the soils that are not acid, in order to produce maximum yields.

CROPPING SYSTEMS FOR SOILS OF THE UPLANDS

The light-colored upland soils in this area are low in natural fertility under virgin conditions, and most of them are sandy. Row crops, such as cotton and corn, have been grown extensively because

they provide a cash income. Under this type of farming, severe losses of soil have occurred on sloping land. Cotton and grain sorghums can be grown where corn does not return profitable yields, but these crops do not protect the surface soil from the destructive effect of rapid run-off. Cowpeas and peanuts also produce fair crops on poor soil when moisture conditions are favorable, but too frequently these crops are removed from the land and no residues returned. Growing cowpeas in every third row with sorghums or corn improves yields of grain that are less than 30 bushels an acre.

On poor sandy land, rye and oats make better yields than barley or wheat, and these crops also protect the land from erosion to a greater extent than clean-cultivated crops. Rye and winter oats provide some pasture during fall and early spring and also provide an opportunity for the growth of lespedeza, which improves the nitrogen content of the soil. A one-row drill equipped with a fertilizer attachment that spaces the rows of small grain about 12 inches apart provides an inexpensive tool, which can be used wherever a limited acreage of small grain is grown in a cropping system. Lespedeza planted in March on land where rye or oats are growing will make a satisfactory growth after the rye and oats are harvested or removed for hay if moisture conditions are favorable during summer and early fall.

Approximately 67 percent of the land in Pontotoc County is operated by tenants. Row crops require less expensive equipment for planting and harvesting than small grain; consequently tenant farmers on poor land will continue to follow a row cropping system, even though experiments indicate the greater effectiveness of small grains and grass in protecting the surface soil from the destructive effect of rapid run-off.

Hairy vetch is a very good crop for sandy soil. On poor land, however, this crop will fail unless it is fertilized with a good supply of phosphorus at the time of planting. When rainfall is light during September or October, it is difficult to obtain a good stand of hairy vetch when planted between rows of cotton or kafir, and these two crops are commonly grown on poor sandy soil, where the vetch should be planted. The best seedbed for hairy vetch is produced by disking or plowing the land after small grain is harvested, in order to control vegetation and store moisture in the soil during the summer. Hairy vetch sometimes reseeds itself and becomes a weed in the following crop, but it is not difficult to control when row crops are grown before small grain is planted in the fields.

The dark-colored soils of the uplands in Pontotoc County are more productive under average conditions than the light-colored soils of the uplands, because they contain larger quantities of organic matter and other essential nutrients. Many of these soils, especially those of the Denton and Summit series, will produce sweetclover without fertilization. Oats, winter barley, and winter wheat produce good yields on these soils. Spring oats make a better nurse crop for sweetclover or lespedeza than winter barley or wheat. Since a nurse crop competes with the young legumes for moisture and sunlight, a more favorable condition can be provided for the development of the legume seedlings by planting the small grain in rows 14 inches apart. This is accomplished by closing every other opening in the drill. The sweetclover or lespedeza seed should be broadcast

over the area at the rate of 12 to 15 pounds an acre during the latter part of February or early part of March. In order to obtain the best results, the legume should be drilled across the rows of wheat or winter barley when the surface of the land has been packed by fall and winter rains. Harrowing the land before and after the seed is broadcast provides sufficient cover for the seed when spring rainfall is favorable.

A 4- or 5-year rotation with sweetclover should maintain the nitrogen content of a soil where good yields of this crop can be produced. The crop can be harvested for seed, pastured, or turned under. In a lespedeza-small grain cropping system the small grain can be planted every year, and, since the lespedeza is an annual, it will reseed if fall tillage is delayed until the latter part of September. Annual sweetclover has some possibilities, but this crop does not provide so much summer pasture as lespedeza. The maximum effect of the annual sweetclover is obtained when this crop is planted alone following Sudan grass or sorghum either planted in rows or drilled and harvested for hay.

Cotton land provides a very good seedbed for oats; consequently a 4-year rotation with oats and sweetclover, followed by corn and cotton, is suitable on many soil types in this area. Where sweetclover and lespedeza cannot be grown, cowpeas planted in alternate rows with corn or kafir helps in maintaining the productivity of the land. Two rows of corn or kafir and one row of cowpeas is a system in which one-third of the land is in a legume crop each year and is essentially a 3-year rotation. Experiments indicate that the yields of corn or kafir under such conditions are greater than those obtained from a similar area where two-thirds of a field is planted to corn or kafir and one-third is planted to cowpeas. This is due to a more favorable utilization of moisture during the growing season.

CROPPING SYSTEMS FOR SOILS OF THE BOTTOM LANDS

The maintenance of soil fertility in bottom lands is not a difficult problem where alfalfa is grown in the cropping system. Most of the soils of the bottom lands in Pontotoc County are not acid. A deficiency in phosphorus may occur where the parent material is composed of alluvium that has been transported from phosphorus-deficient areas. On the sandier land where alfalfa is not well adapted to the soil, cowpeas, hairy vetch, or sweetclover can be used to aid in maintaining the nitrogen content of the soil. The growth of Johnson grass is a serious problem on some of the soils of the bottom lands, especially in those areas where row crops, such as cotton and corn, are planted every year. Johnson grass is not objectionable, however, if it can be used for pasture or hay. Land infested with Johnson grass can be plowed during the summer and planted to a small grain, such as winter wheat or barley, on those areas where overflow is not a serious problem. The small grain usually is harvested before the Johnson grass is very tall. Johnson grass develops during the summer and can be used for pasture or hay, or it can be destroyed by summer tillage, a method that is most effective when the season is dry. Exposing the roots to freezing during the winter also aids in reducing the number of plants in a field. Planting small grain cannot be recommended, however, on Johnson-grass-infested land that is sub-

ject to severe overflow during May and June. Here, the development of a Johnson-grass or Bermuda-grass pasture will be more productive where a livestock system of farming is followed than the utilization of such land for cotton or corn, which crops may be damaged or destroyed frequently as a result of the overflow.

POTENTIAL FERTILITY IN RELATION TO SOIL IMPROVEMENT

The results of the chemical analyses of soils in this county are given in table 9.

TABLE 9.—*Chemical composition of soils in Pontotoc County, Okla.*

DARK-COLORED SOILS OF THE UPLANDS

Soil type and sample No.	Location	Depth	pH	Organic matter	Total nitrogen	Total phosphorus	Readily available phosphorus
		Inches		*Percent*	*Percent*	*Percent*	*Parts per million*
Newtonia silt loam:							
5242	NE¼NE¼ sec. 21, T. 1 N., R. 6 E.	0- 2	6.1	4.97	0.181	0.029	12
5243		2- 8	6.4	3.69	.147	.027	8
5244		8-19	6.1	1.86	.081	.021	4
5245		19-42	6.0	1.03	.049	.021	2
5246		42-48	6.0	.88	.065	.018	2
Denton clay loam, deep phase:							
5154	NW¼NE¼ sec. 24, T. 2 N., R. 6 E.	0- 4	6.9	6.40	.245	.050	80
5155		4-10	7.2	3.30	.139	.061	56
5156		10-42	7.5	1.23	.023	.083	44
Durant fine sandy loam:							
5129	SE¼NE¼ sec. 8, T. 2 N., R. 5 E.	0- 2	7.3	1.97	.062	.016	26
5130		2- 8	7.2	1.57	.052	.013	8
5131		8-13	7.0	1.47	.057	.013	2
5132		13-20	6.4	1.25	.057	.014	0
5133		20-30	6.5	.86	.038	.014	0
5134		30-52	6.0	.32	.025	.009	0
Durant very fine sandy loam:							
5138	N½SE¼ sec. 24, T. 3 N., R. 5 E.	0- 9	6.9	3.26	.132	.015	8
5139		9-17	7.0	2.50	.106	.014	6
5140		17-30	6.5	1.38	.025	.013	6
5141		30-36	6.8	.88	.038	.013	6
5142		36-54	7.5	.68	.032	.010	4
Parsons very fine sandy loam:							
5146	NE¼NE¼ sec. 9, T. 3 N., R. 7 E.	0- 6	5.2	1.91	.087	.017	8
5147		6-14	5.5	1.92	.090	.019	6
5148		14-18	6.5	.94	.043	.014	0
5149		18-30	5.2	1.16	.052	.013	0
5150		30-48	6.7	.56	.035	.012	0
Vanoss fine sandy loam:							
5185	SW¼NW¼ sec. 7, T. 4 N., R. 4 E.	0- 2	7.2	1.05	.035	.008	4
5186		2-12	6.9	1.03	.059	.011	4
5187		12-20	6.5	1.16	.059	.011	0
5188		20-84	6.3	.23	.022	.006	0
Summit clay loam:							
5192	SW¼SW¼ sec. 13, T. 2 N., R. 6 E.	0- 3	6.1	9.10	.354	.041	14
5193		3-15	6.6	4.00	.221	.028	8
5194		15-26	7.6	1.65	.079	.024	22
5195		26-45	7.6	1.12	.062	.023	0

LIGHT-COLORED SOILS OF THE UPLANDS

Buckhorn fine sandy loam:							
5164	S½SE¼ sec. 19, T. 2 N., R. 5 E.	0-12	6.6	3.72	0.120	0.024	12
5165		12-30	5.3	1.23	.060	.012	0
5166		30-42	5.6	1.14	.051	.012	0
5167		42-52	6.4	.83	.043	.012	0
Cleburne fine sandy loam:							
5228	W½NW¼ sec. 33, T. 3 N., R. 7 E.	0- 5	7.6	1.34	.038	.016	36
5229		5-21	7.1	.61	.017	.015	14
5230		21-36	6.2	1.14	.032	.020	30
5231		36-50	6.1	.58	.032	.014	10

TABLE 9.—*Chemical composition of soils in Pontotoc County, Okla.*—Continued

LIGHT-COLORED SOILS OF THE UPLANDS—Continued

Soil type and sample No.	Location	Depth	pH	Organic matter	Total nitrogen	Total phosphorus	Readily available phosphorus
		Inches		*Percent*	*Percent*	*Percent*	*Parts per million*
Dougherty fine sandy loam, shallow phase:							
5120	NW¼NW¼ sec. 29, T. 5 N., R. 4 E.	0–2	6.1	1.63	0.064	0.009	4
5121		2–12	6.3	.17	.011	.005	0
5122		12–37	5.1	.45	.019	.008	0
5123		37–60	5.9	.11	.016	.005	0
Hanceville fine sandy loam:							
5210	NW¼NW¼ sec. 36, T. 4 N., R. 6 E.	0–4	6.2	3.95	.152	.019	14
5211		4–10	6.1	1.13	.025	.007	0
5212		10–22	4.6	.86	.041	.013	0
5213		22–30	5.1	.57	.032	.007	2
5214		30–40	6.1	.66	.033	.007	0

SHALLOW SOILS OF THE UPLANDS

Chigley gravelly loam:							
5159	E½SE¼ sec. 14, T. 3 N., R. 4 E.	0–6	7.7	3.90	0.132	0.023	20
5160		6–9	7.5	1.26	.043	.011	4
5161		9–12	6.4	.62	.019	.009	4
Roff gravelly loam:							
5204	NW¼NW¼ sec. 17, T. 2 N., R. 4 E.	0–10	7.0	1.76	.079	.014	2
5205		10–18	7.0	1.05	.060	.014	2
5206		18–30	6.4	1.27	.071	.015	2
5207		30–60	6.4	.62	.038	.011	0
Talihina very fine sandy loam:							
5103	NE¼NE¼ sec. 4, T. 2 N., R. 6 E.	0–5	6.2	2.29	.099	.044	24
5104		5+	4.4	1.15	.074	.025	20
Vernon clay:							
5178	W½SW¼ sec. 35, T. 5 N., R. 4 E.	0–2	6.3	4.11	.172	.030	32
5179		2–7	6.3	2.74	.109	.024	12
5180		7–20	5.4	1.30	.074	.018	8
5181		20–36	7.6	.80	.045	.035	128
5182		36–57	7.5	.61	.034	.033	50

SOILS OF THE TERRACES AND BOTTOM LANDS

Brewer very fine sandy loam:							
5234	NE¼NE¼ sec. 27, T. 5 N., R. 4 E.	0–3	6.4	1.87	0.081	0.014	8
5235		3–18	5.9	1.09	.065	.012	2
5236		18–21	6.0	.89	.033	.012	0
5237		21–30	6.3	1.41	.043	.011	0
5238		30–50	7.9	.38	.007	.007	0
Osage clay loam:							
5222	SE¼SE¼ sec. 21, T. 4 N., R. 5 E.	0–13	7.3	4.14	.182	.058	160
5223		13–32	7.4	3.09	.120	.047	96
5224		32–42	7.6	1.90	.035	.037	140
5225		42–50	7.8	1.74	.056	.041	160
Stidham fine sandy loam:							
5114	W½NW¼ sec. 6, T. 4 N., R. 4 E.	0–5	6.0	2.58	.079	.011	4
5115		5–21	6.1	.27	.015	.005	0
5116		21–35	6.2	.30	.018	.006	0
5117		35–45	6.0	.10	.020	.006	0
Stidham fine sand:							
5217	NW¼NW¼ sec. 9, T. 5 N., R. 6 E.	0–8	7.9	1.08	.052	.014	28
5218		8–35	8.0	.37	.019	.007	12
5219		35–65	8.0	.30	.017	.007	8
Teller very fine sandy loam:							
5109	SW¼SW¼ sec. 6, T. 5 N., R. 5 E.	0–18	7.0	1.17	.056	.024	24
5110		18–36	7.1	1.40	.081	.027	8
5111		36–60	6.5	1.18	.053	.019	4
Verdigris clay loam:							
5172	NW¼SW¼ sec. 21, T. 4 N., R. 5 E.	0–10	7.2	2.08	.090	.030	56
5173		10–24	6.8	.81	.051	.021	48
5174		24–36	7.2	1.24	.070	.019	42
5175		36–64	7.2	.53	.035	.019	34
Verdigris fine sandy loam:							
5106	NW¼NW¼ sec. 17, T. 4 N., R. 4 E.	0–14	6.8	1.70	.079	.021	24
5107		14–35	6.7	.55	.103	.026	16

These data show that the surface layers in this county generally contain more organic matter, nitrogen, and phosphorus than the subsurface layers. The reduction in the deeper layers of soil is more pronounced in respect to organic matter, nitrogen, and readily available phosphorus than in respect to total phosphorus. A study of the readily available phosphorus indicates that a larger quantity of this important nutrient is present in the surface layers, owing to the removal of phosphorus from the deeper layers by plant roots and the accumulation of the plant residues in the surface soil.

Soils developed on alluvium or from material derived from the weathering of Arbuckle limestone or calcareous shales contain more available phosphorus than soils developed on weathered sandstone or alluvium that has been transported from these areas. Analyses show that the following soils are not deficient in phosphorus: Denton clay loam, Cleburne fine sandy loam, Talihina very fine sandy loam, Vernon clay, Osage clay loam, and Verdigris clay loam. Although the response to phosphorus fertilizer within a soil varies, it is more likely to be present in a sandier soil than in a fine-textured one. Tests for available phosphorus can be used as an index of phosphorus deficiency and should be made before fertilizers are applied or crops having a high phosphate requirement are planted.

The soil reaction of these profiles is quite variable. High acidity seems to prevail in certain horizons in some of the profiles. Samples of cultivated soils, under average conditions, are more acid than samples of virgin soils collected from the same area; consequently the analyses of virgin soils will be less acid and higher in percentage of the various nutrients than samples collected from a similar area of cropped land. Soils that have a pH value higher than 6.0 do not respond to applications of finely ground limestone if the subsoil is not acid. Newtonia silt loam and similar soils will respond to an application of limestone when alfalfa and sweetclover are planted. Summit clay loam and similar soils will not respond to applications of limestone where these crops are planted, because the subsurface layers contain an abundance of lime, and plant roots extending into the subsurface soil can obtain an abundance of lime.

The organic-matter content of many of these soils is low even under virgin conditions. The crop-producing capacity of soil containing less than 2 percent of organic matter depends to a very great extent on the utilization of desirable cropping systems that return a good supply of available organic matter and nitrogen to the soil at frequent intervals. The light-colored soils of the uplands and the sandier types of the dark-colored soils of the uplands are lower in organic matter than soils containing a higher proportion of silt and clay.

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of the forces of the environment acting on the soil materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent soil material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the relief, or lay of the land, which determines the local or internal climate of the soil, its drainage, moisture content, aeration, and susceptibility to erosion; (4)

the biologic forces acting upon the soil material—the plants and animals living upon and in it; and (5) the length of time the climatic and biologic forces have acted on the soil material.[5]

Pontotoc County is located in the region of pedalferic soils, and the soils belong to the Prairie, Reddish Prairie, Rendzina, and Red and Yellow Podzolic great soil groups. Parent materials with low content of bases have developed into Red and Yellow Podzolic soils, as a rule, and parent materials with a high content of bases have developed into Rendzina, Prairie, and Reddish Prairie soils. The parent materials are varied, but the dominant types are limestone, dolomitic limestone, granitic conglomerate, sandstone, shale, and unconsolidated sands and clays.

The climate is temperate and moderately humid. The mean annual rainfall is 39.97 inches, and the mean annual temperature is 61.8° F. Climatic conditions such as these bring about considerable downward movement of moisture through the surface soil and the subsoil, so that considerable leaching has occurred in the mature soils under a forest cover, which are members of the Red and Yellow Podzolic soil group. In the soils developed under a grass cover, the bases have been leached downward to some extent and little eluviation of the surface soil has occurred. These soils are members of the Prairie, Rendzina, and Reddish Prairie soil groups.

The normal Prairie soils in this county have a rather thick surface soil, which is very dark brown, neutral or faintly acid in reaction, and faintly granular. The surface soil is thicker and darker on the more level land and much shallower and lighter colored on the rolling to hilly land. The soils developing from one type of parent material generally are divided into about three series or phases on the bases of color and depth of the surface soil, variations of which are the result of greater run-off and, therefore, drier soil climate on the steeper slopes. Removal of the surface soil by erosion is another factor in determining its depth. The principal soils represented in the group of Prairie soils are those of the Durant, Summit, Roff, and Vanoss series.

The Reddish Prairie soils are apparently developed from sandstones and limestones that contained a high percentage of ferric iron. These soils have brown or dark-brown surface soils and reddish-brown subsoils. The Newtonia and Fitzhugh soils are members of this group.

The Rendzina soils are developed from soft limestones and highly calcareous shales or marls. The parent rock has disintegrated or weathered rather rapidly, and a fairly deep soil profile has developed except on steep surfaces. A dark color, granular structure, and neutral reaction characterize these soils, which are included in the Denton series.

Following is a description of a typical profile of Durant very fine sandy loam, one of the principal soils of this group. It is a normal Prairie soil developed from calcareous sandstone.

1. 0 to 8 inches, very dark grayish-brown or nearly black slightly granular rather friable very fine sandy loam. The pH value is 7.5, according to field tests. The material readily breaks into small soft irregular

[5] For further information, concerning soil formation, morphology, and classification, see Soils and Men, U. S. Dept. Agr. Yearbook 1938.

aggregates. The crushed material is slightly lighter colored than the broken material.

2. 8 to 17 inches, very dark grayish-brown loam, which in dry exposed cuts breaks vertically into large prisms ranging from 5 to 8 inches in diameter. These, in turn, break horizontally or obliquely at intervals of 2 to 5 inches, forming large blocks or prisms. The prisms have bumpy surfaces and are not shiny. Worm casts are very plentiful. Field tests indicate the same pH value as in the layer above.
3. 17 to 30 inches, brown and dark-brown mottled clay loam, with reddish specks here and there, which is rather friable but does not break into prisms. Some insect casts are present. The crushed material is light brown. The pH value is the same as in the two overlying layers.
4. 30 to 36 inches, mottled brown, yellowish-brown, and rust-brown clay loam containing a few rounded iron concretions. The pH value is 7.0.
5. 36 to 54 inches, yellow, gray, and rust-brown clay loam with numerous black iron or manganese concretions. In spots, the material in this layer contains sufficient lime to produce effervescence with dilute hydrochloric acid. The fine earth is not calcareous.
6. 54 to 65 inches, mottled yellow and gray calcareous clay loam containing a few black concretions of iron or manganese.
7. 65 to 70 inches, mottled yellow and gray very fine sandy loam with numerous fragments of weathered sandstone. The fine earth is calcareous.

Sandstone bedrock lies at a depth of 70 inches below the surface.

This soil has developed on a generally smooth relief, with moderately free drainage, under a heavy sod of prairie grasses consisting largely of bluestem, grama, and buffalo grasses. The subsoil is heavier textured than the surface soil, but the contrast in color and texture between the surface soil and the subsoil is not so sharp as in the forested soils.

The normal forested soil in this county has a thin layer of organic matter in the upper part of the surface soil, which is underlain by a distinctly grayish-yellow or much lighter colored subsurface layer. This rests on yellowish-red or reddish-yellow sandy clay or clay. The reaction of these soils in most places is acid, except in the thin dark surface layer, which is neutral. The principal soil series in this group are Hanceville, Cleburne, Stidham, Dougherty, Chigley, and Buckhorn.

Following is a description of the profile of Hanceville fine sandy loam, a Red Podzolic soil, which is a normal forested soil developed from noncalcareous sandstone.

1. 0 to 4 inches, brown to grayish-brown loose friable fine sandy loam, with a pH value of 7.0, according to field test.
2. 4 to 10 inches, grayish-yellow or pale-yellow friable loose fine sand, with the same pH value as the material above.
3. 10 to 22 inches, yellowish-red friable clay, indistinctly mottled with red. The pH value is 4.0.
4. 22 to 30 inches, mottled red, yellow, and gray moderately friable clay or clay loam, with red predominant. It has a pH value of 4.5.
5. 30 to 41 inches, gray, red, and yellow fine sandy clay, with gray predominant. This grades into unweathered bedrock of sandstone.

SUMMARY

Pontotoc County is situated in the humid region in south-central Oklahoma and has an annual precipitation of 39.97 inches. The native vegetation consists of both prairie and forest types. The county is irregular in surface topography, with many escarpments, hills, and gullies, and most farms include some land suited only for grazing. For this reason the agriculture is rather diversified. The

county is located in the Cotton Belt, but corn, oats, and sorghums are also important crops, as they furnish additional feed to supplement the native pastures during the winter and spring and also furnish feed for horses used in tillage operations. Cotton and corn compete for dominance in the cropping systems. The cotton acreage is the larger following periods of high prices for cotton, and the corn acreage is the larger at other times.

The comparatively large areas of rough land support a forest cover. As most of the virgin forest has been logged, the present tree growth is not large and is cut mainly for fence posts and firewood. The rougher land that supports native grasses is used for pasture, and much of it is included in large cattle ranches. About 60 percent of the land in the county is in pasture and forest land.

The soils are moderately fertile, but most of them have lost much of their natural fertility as a result of improper management and erosion. Only in a very small part of the county is the land so level that erosion is not active. The soils for the most part are neutral to acid in reaction and are low in content of available phosphorus. The Prairie and Rendzina soils have a moderately high organic-matter content where erosion is not severe and, in most places, a neutral to slightly acid reaction. The forested soils, on the other hand, are very low in organic matter and nitrogen and in general are strongly acid.

The soils have been classified in 33 soil types and phases on the basis of soil profile characteristics, and, in addition, 4 miscellaneous land types have been separated. These soils and land types have been placed in five groups, based on their general soil character and agricultural value, as follows: (1) Dark-colored soils of the uplands and terraces, (2) light-colored soils of the uplands and terraces, (3) soils of the bottom lands, (4) shallow soils of the uplands, and (5) nonarable soils and land types.

The dark-colored soils of the uplands and terraces consist of soils developed under a heavy sod of native grasses, largely bluestem, blue grama, side-oats grama, and buffalo grass. These soils, where normally developed, are moderately high in organic matter and nitrogen but probably are somewhat low in available phosphorus. Most of them are neutral in reaction, but a few are acid. The surface soils are moderately dark or dark, granular, and friable. They gradually become heavier and lighter colored with depth. The subsoils are not highly colored as are most of the sandy light-colored soils developed under forest. These soils have developed largely from shales and rocks having a comparatively high content of calcium carbonate. They are suited to the production of corn, oats, cotton, sorghums, and native hay and are the most important agricultural soils of the county. They cover 25.8 percent of the total area. Durant very fine sandy loam is the most important soil of this group.

The light-colored soils of the uplands and terraces consist of leached or podzolized soils of moderate to low fertility. These soils, under native conditions, supported a cover of trees consisting largely of post oak and blackjack oak. They are acid in reaction and low in content of nitrogen, organic matter, and available phosphorus. The surface soils in cultivated fields are light-colored and sandy textured. A thin dark layer lies at the immediate surface in native

forest land. The subsoils are distinctly heavier and more highly colored than the surface soils. They are red, yellowish red, or yellow. These soils are suited to the production of cotton, peanuts, watermelons, cowpeas, grapes, and peaches, but they are not well suited for the production of corn, although some is grown. These soils cover 19.9 percent of the area of the county. The dominant soil in this group is Hanceville fine sandy loam.

The soils of the bottom lands consist of low-lying soils on the stream flood plains. These soils are productive, although crops are sometimes damaged by overflow. Considerable alfalfa and corn are grown on them. The soils of this group, of which Verdigris clay loam is the most important, cover 14.8 percent of the area of the county.

The shallow soils of the uplands comprise those with thin surface soils as a result of rolling relief, which promotes rapid run-off and erosion. Both forested and grassland soils are included in this group. The subsoils in many places are exposed by the plow. These soils are cultivated to some extent but are better suited to native hay and pasture. They cover 16.8 percent of the area of the county. Durant very fine sandy loam, eroded phase, is the dominant member of this group.

Miscellaneous, stony, or rough broken lands that are unsuited to the growth of cultivated crops are placed in the group of nonarable soils and land types. These soils are utilized only for forestry and pasture. They cover an area of 22.7 percent of the county. Rough stony land (Hector soil material) is the most extensive member of this group, and it is not a very valuable soil, even for grazing. Rough stony land (Denton soil material), Denton stony loam, and Crawford stony loam, although nonarable, do, however, support a good growth of nutritious grasses and afford valuable pasturage for livestock, especially beef cattle.

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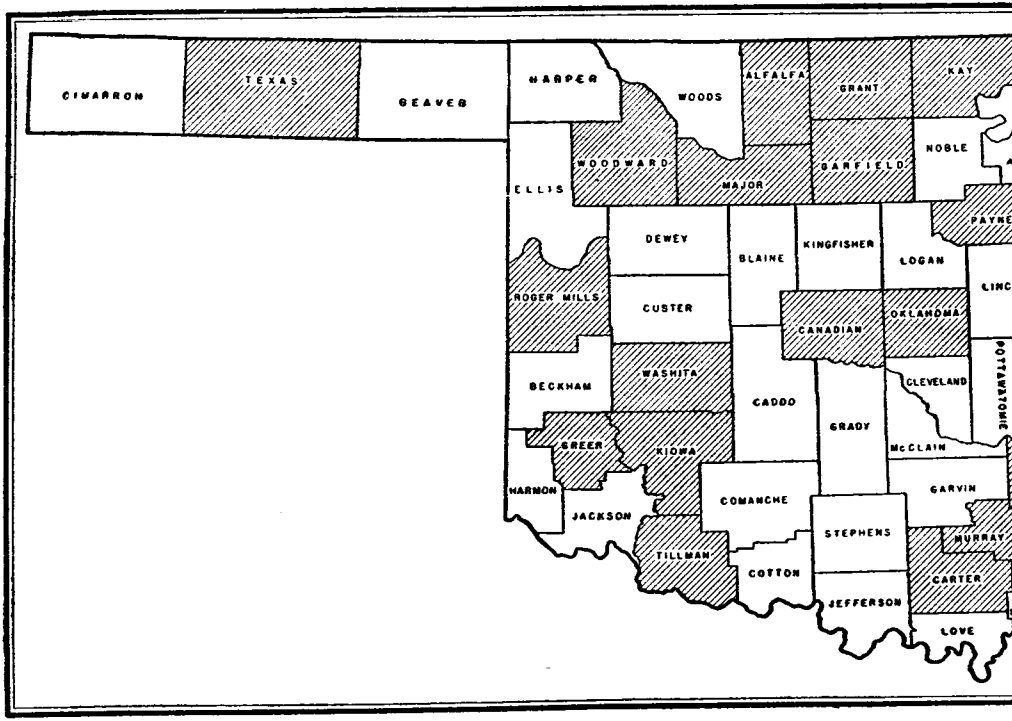

Areas surveyed in Oklahoma, shown by shading.

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MAP DRAFTING, J. W. McKERICHER, IN CHARGE

SOIL MAP
PONTOTOC COUNTY
OKLAHOMA

OKLAHOMA AGRICULTURAL EXPERIMENT STATION
C. P. BLACKWELL, DIRECTOR
AGRONOMY DEPARTMENT
H. J. HARPER, PROFESSOR OF SOILS

LEGEND

DARK-COLORED SOILS

FINE SANDY LOAMS — VERY FINE SANDY LOAMS

Durant fine sandy loam — Ds	Brewer very fine sandy loam — Bv
Fitzhugh fine sandy loam — Fl	Durant very fine sandy loam — Dv
Vanoss fine sandy loam — Va	Parsons very fine sandy loam — Pa

CLAY LOAMS — SILT LOAM — LOAM

Denton clay loam, Deep phase — Dc	Newtonia silt loam — Ns
Summit clay loam — Su	Rolf gravelly loam — Rg

LIGHT-COLORED SOILS

SANDSTONE SUBSTRATUM — SANDY CLAY SUBSTRATUM

Buckhorn fine sandy loam — Bf	Dougherty fine sandy loam — Do
Cleburne fine sandy loam — Cf	Stidham fine sandy loam — Sf
Hanceville fine sandy loam — Ha	

GRANITIC SUBSTRATUM — GREATLY LEACHED OR ERODED SOILS

	Stidham fine sand — St
Chigley fine sandy loam — Cs	Stidham fine sandy loam, Rolling phase — Sl

SOILS OF THE BOTTOM LANDS

HEAVY SOILS OF FLOOD PLAINS — SANDY SOILS OF FLOOD PLAINS

Osage clay loam — Oc	Verdigris fine sandy loam — Vf
Verdigris clay loam — Vm	Yahola fine sand — Yf
	Yahola very fine sandy loam — Yv

SOILS OF FLOOD PLAINS, MAINLY TIMBERED

Teller very fine sandy loam — Tv

SHALLOW SOILS

SANDY SOILS — HEAVY SOILS

Dougherty fine sandy loam, Shallow phase — Do	Chigley gravelly loam — Cg
Durant very fine sandy loam, Eroded phase — Dv	Denton clay loam — Dc
	Rolf gravelly loam, Shallow phase — Rg
	Vernon clay — Vn

NONARABLE SOILS AND LANDS

SMOOTH TO ROLLING LANDS — ROUGH AND STEEP LANDS

Crawford stony loam — Cr	Rough stony land — RsD
Denton stony clay loam — Dy	Denton soil material
	Hector soil material — RsH
Talihina very fine sandy loam — Tf	
Riverwash — Rv	

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads, Steam and Electric
- Bridges, Ferry
- R.R. Crossings, Tunnel
- Ford, Dam, Sawmill, Windmill
- Boundary lines
- School, Church, Creamery, Cemeteries
- Boundary lines
- Triangulation station, Boundary monument, Oil or Gas wells
- U.S. Township and Section lines, Recovered corners
- Forest fire station, Airway beacon, Oil or Gas tanks
- Transmission line, Oil or Gas pipe line
- Mine or Quarry, Rock outcrop, Made land
- Soil boundaries, Stony, Gravelly and Cherty areas

DRAINAGE
(Printed in blue)

- Streams, Springs, Wells, Flowing wells
- Lakes, Ponds, Intermittent lakes
- Unsurveyed and Intermittent streams
- Water-pipe lines, Canals, Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

William T. Carter, Inspector, District 4.
Soils surveyed by E. G. Fitzpatrick, in charge, and A. W. Goke, U. S. Department of Agriculture, and L. E. Rose, Orville Stout, and C. F. Fisher, Oklahoma Agricultural Experiment Station.

Scale 1 inch = 1 mile
1 ½ 0 1 2 3 4 Miles

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Polyconic projection, 1927 North American Datum.
Horizontal control by U. S. G. S., and U. S. C. and G. S.
10000 foot grid based upon Oklahoma (South) system of plain coordinates.
Surveyed in 1934-36. Series of 1936.